How to Produce High-Quality QuickTime™

By Terran Interactive, Inc.
www.terran.com

TERRAN
INTERACTIVE ®

Make the Most of Your Media!

Table of Contents

Introduction

Welcome to "How to Produce High-Quality QuickTime." This document will help you understand the process of creating, preparing and delivering professional-quality QuickTime projects.

This document was written for developers and video professionals who want to "do it right." If you are new to creating and delivering QuickTime movies, this document should help give you a good understanding of the basics and help you get started. If you're a QuickTime professional, we hope that the details and tips contained in this document will help you deliver even better QuickTime movies.

Scope of this Document

A detailed description of every step, program and aspect of producing high-quality QuickTime would literally take several books.

To keep this document approachable, we'll present an overview of the entire process but focus primarily on how to prepare/compress QuickTime movies because this is the least understood part of the production process. We'll also discuss the creation of content in some depth because it has such a profound impact on final movie quality.

QuickTime™

For the purposes of this document, we'll be focusing on audio and video QuickTime movies and won't be discussing QuickTime VR, QuickTime interactivity and other QuickTime features in much depth. Please keep in mind that QuickTime is much more than just synchronized audio and video – the breadth of the QuickTime architecture is a big reason why it continues to be the industry standard for cross-platform multimedia delivery.

This document will briefly discuss local and network distribution of QuickTime but won't discuss QuickTime Streaming. Once Apple makes more public announcements about QuickTime Streaming, we'll add a section addressing this exciting new technology.

Much of what is discussed here is equally applicable to Mac OS and Windows. Remember that QuickTime is a cross-platform technology, and you can author QuickTime on the Mac for delivery on Windows machines, and vice versa.

For your convenience, we've also added an extensive glossary at the end of this document to help you sort out many of the terms used in multimedia and networks.

About the Authors...

This document is written by Terran Interactive, Inc., the makers of Media Cleaner Pro. Media Cleaner is the industry standard for preparing high-quality QuickTime movies.

Terran has been deeply involved with QuickTime for more than four years. Terran's roots lie in video compression service work, and our products have sprung directly from needs we encountered while producing high-quality video for clients on tight deadlines.

Terran provides media delivery solutions to our customers by offering QuickTime-related software products. To learn more about Terran and the products we offer, please visit our Web page at http://www.terran.com.

Perspective and Expectations

A big part of learning how to effectively create and deliver QuickTime movies is having realistic expectations.

Your computer is not a television – each technology has different strengths and weaknesses, and they aren't interchangeable. For example, the computer is more flexible than TV and offers exciting

Computers are not Televisions

opportunities for interactivity missing from television. However, bandwidth limitations often mean desktop video doesn't look as good as television.

While desktop delivery offers more options, it's also less standardized. There is never any doubt that TV viewers can watch a specific channel, but desktop video isn't such a given. QuickTime simplifies distribution, but you still must understand the system requirements for given technologies and make sure your viewers have the correct software installed.

Desktop video, especially video delivered over a network, uses substantially lower bandwidth than television. This means that as a developer you must make tradeoffs between size, image quality and frame rate that aren't required with television.

It is also important to understand what compressed QuickTime can look like at a given bandwidth. Many clients have unrealistic expectations of the quality that is currently possible, and part of your job is to educate them on what can and can't be done with today's technologies.

That said, QuickTime and its codecs and tools keep getting better. The quality that you can currently deliver with QuickTime 4 was unattainable even a year ago. Plus, your knowledge as a producer of desktop video can make a huge difference in the quality of your final movies.

To Out-Source or Not to Out-Source

Before we go much further in this document, a fundamental question you should ask yourself is whether you want to produce and prepare your material yourself or hire a team of professionals to do it for you.

There are pros and cons with each option, and you should spend some serious thought on this question. This document will give you a better idea of the work involved with producing a project yourself – if you're not sure if you want to do it in-house or out-source the job, keep reading.

Even if you plan to have your material produced by a professional, we strongly recommend that you read the rest of this document. Understanding what's involved with producing high-quality QuickTime will help you have realistic expectations of what your production team can do, as well as give you some better ideas on how to plan your project.

Finally, even if you are sure you want to create the material yourself but are new to video, we recommend you consider using a professional team for the actual production of your video. Shooting good video is tough and requires a lot of experience and hardware. This is one part of the production process that is often best left to professionals. If you start with amateur video, you will end up with amateur-looking results, regardless of your skill with editing or compression.

If you do decide to outsource your project or video production, we recommend that you visit Terran's User Gallery for a list of production houses that are experts with QuickTime.

Quality Counts

The fundamental philosophy of making high-quality QuickTime is preserving the maximum quality possible at every step. A "holistic" approach of keeping the entire production process in mind and carefully planning each step to minimize quality loss is the key to producing excellent results.

When you create a movie, you start with the real world in all its three-dimensional glory. Video/film can only reproduce a two-dimensional image of the real world, and the images, colors, sounds, etc. contain a lot less detail than the original subjects. When you create this video, you must use a high-quality camera, good lighting and professional production practices to preserve as much detail as possible from the real world.

In order to actually deliver your video to viewers, you will need to compress it. This compression will dramatically reduce the amount of information contained in the final movie. Minimizing the loss of quality during this step is critical to high-quality final results.

Understanding how to successfully accomplish this translation from the real world to the desktop is the purpose of this document.

NOTE: Many developers mistakenly believe that because their final movie will be small and low-bandwidth, they don't need to be careful in how they light, shoot, capture and edit their video. This is absolutely not true – the old saying "Garbage in, garbage out" is a fundamental tenet of desktop video. The best final video is only possible when you start with careful planning and excellent source material and then prepare your video with the utmost care.

Sanity Check

Working with multimedia can be very exciting and rewarding, but it can also be a frustrating experience. Not everyone will have problems, but our experience has been that the equipment and software used in multimedia production is often "on the cutting edge" and you may experience occasional crashes or bugs.

This is not to say that you will have problems, but rather you're not alone if you do... and even if your computer crashes, you may not be doing anything wrong.

Just remember to leave some room in your deadlines for unexpected problems, especially with new hardware or software. Keep your system extensions and devices to an absolute minimum. Once you've got your system working really well, back it up (especially your System folder) so you don't have to start from scratch if the multimedia gremlins attack.

NOTE: To back up your system completely on a Macintosh, you must boot from a different drive – the Mac cannot copy certain System resources while that System is running the computer. The easiest way to do this is to put a System disc in the CD-ROM drive, restart, and hold down the "C" key during startup – this will cause your Mac to boot from the system on the CD. Once the computer is done restarting, you can completely copy your normal System folder, because it isn't currently in use.

Sanity Check - Multimedia is fun, but can also be frustrating

Overview

Five Steps to Great QuickTime

Successfully producing high-quality QuickTime projects involves five major steps, which are outlined below.

These steps taken together are often called "workflow." Understanding, planning and testing each step in the workflow prior to starting production is the best way to ensure high-quality results while minimizing your production time.

NOTE: The bulk of this document details the creation and preparation steps, since these are the areas in which most mistakes which lower the quality of the final project are made. The other steps are provided here to help place the preparation step in context while offering you some helpful tips.

How to Produce High-Quality QuickTime

1. Planning the Project
To produce a successful project, you must first figure out what you are trying to do with it, then create a plan for accomplishing your goals.

2. Creating the Content
Creating the content involves actually shooting the video, then getting it into the computer and editing it. Professional production values are essential, and there are several details you should understand to maximize the quality of the final QuickTime movie.

3. Preparing Content for Delivery
Compressing your final movie to prepare it for delivery is often the least understood step of the production process and the most common source of mistakes. Compression has a huge impact on quality, and we'll outline how to do it right.

4. Authoring the Project
The authoring step is where you assemble your compressed video, graphics and elements into your final interactive project or Web page. Careful prior planning will make authoring the project dramatically easier.

5. Delivering the Project
Once you've finished producing your final project, you need to get it to your viewers. Common delivery methods include the Web, CD-ROM, DVD and kiosk/presentations.

Tools and Resources
To produce high-quality QuickTime, you need high-quality tools and the professional codecs. We've also listed some helpful online resources for further research.

1: **Planning**

If you want to reliably deliver great results on time, we strongly recommend that you carefully plan your projects. Investing your time in early planning pays off later by eliminating reshoots and reworks. Getting the job done right the first time helps you satisfy your clients while increasing your profits.

To plan effectively, you first need to determine the specifics of what you are trying to accomplish with your project. You must evaluate your target audience and the requirements of delivering video to them. After you have a good idea of the project goals and audience, you should choose your delivery methods. Then, you should create a project specification, a storyboard/script and a proof of concept. Finally, be sure to get your client to "sign off" on the project prior to starting production.

Determine Your Goals

It's hard to reach your goals unless you have a clear understanding of what they are. This is so obvious that it's often overlooked or too many assumptions are made. Make sure you know your goals, including:

What are you trying to communicate to the viewer? Are you relating complex technical information, such as online training, or are you trying to impress prospective customers with a flashy advertisement?

How will it be delivered? Online, on a CD, DVD or both? If it will be online, how many users will need to be able to access it simultaneously?

Before you start, you should ask several questions...

What should the final experience be? Will there be multiple media elements present at once? Will the media be watched in a linear fashion or will the user be able to randomly access the file? Are you just delivering movies or do you need to build an interactive experience?

Once you understand your high-level goals, you can start getting more detailed about the technology required to deliver your message.

Determine the Minimum System Requirements

Early in the planning process you should determine the minimum system required for viewing your project.

What are you trying to achieve in terms of quality? Higher quality often requires faster machines and newer technologies. Can you require that viewers have QuickTime installed? Many of the new QuickTime codecs, such as Sorenson Video and QDesign Music, require a PowerPC or Pentium.

If you need to deliver video to 68K Macintoshes, you'll be stuck with older technologies such as Cinepak. If you must support 486 systems and 14.4 modems, you should have realistic expectations for the lower quality this will entail.

There is always a conflict between the higher system requirements needed to deliver the highest-quality video and the lower requirements needed to maximize your audience. Fortunately, QuickTime movie alternates often offer a good solution to this problem.

By preparing multiple versions of your media and then delivering the best version to each viewer, you can avoid producing video that is only aimed at the "lowest common denominator." For more information on making alternates, please see page 40 of this document.

Pick Your Technologies and Tools

There are an impressive collection of multimedia technologies from which to choose. Each of them has their own benefits and drawbacks, and picking a good fit for your project is important. You need to make sure the technology can support your goals. This includes supporting your required media types, playback platforms and interactivity. A good resource to understanding the architectures and codecs available is Codec Central. You can visit CodecCentral at http://www.CodecCentral.com.

Once you've picked your technologies, you'll need to choose the hardware and software tools to use in creating your project. This includes the whole spectrum, including audio/video capture hardware, editing software, compression tools, professional codecs and encoders, authoring software, CD or DVD burners, HTML tools and media servers.

Creating a "proof of concept" (discussed later in this section) will also help you figure out exactly what tools you'll need to actually produce your project.

Write it Down

This may seem obvious, but many developers start a project without a clear written document outlining the media elements they need, how these elements will be created and prepared and a schedule for all the work.

We strongly suggest you create a detailed project specification document. Staying organized during the actual creation and preparation of the elements is much easier when you have a "master plan" from which to plan and track your progress.

You should also have a script written for your video prior to filming – "ad libbing" often causes reshoots when you later realize you didn't get a piece of needed footage. If you are conducting an interview, having carefully prepared questions will speed up the interview and often improve the subject's responses as well.

Proof of Concept & Testing

A wise man once said, "Test early and test often." Before you fill a dozen hard drives with footage, test your production process from start to finish on a few sample files. It's very important to test the entire production process because you are likely to find things later in the process that will make you want to change what you're doing earlier in the process.

Create a proof of concept and test it carefully.

For example, you may realize that the interview video you are shooting looks great when displayed full screen, but the people are too small when scaled down to the size it will appear in the project. Filming the same video closer to the subject might easily address this issue, but figuring this fact out <u>before</u> you've shot all your material is vastly preferable to reshooting the video.

For your CD-ROM projects, the best way to test your movies is to play them within the title interface (or a mock-up of it) on your minimum target machine with the minimum CD-ROM drive on the project specifications. You should play the movie all the way through and watch for dropped frames, skipping audio and loss of sync. For example, if you are using Macromedia's Director to make an interactive CD-ROM title, you should put your test movie into your Director project to play it. If you list "486/66 PC, 2x CD-ROM" as the minimum system requirement on the box, you should play the movie on a typical 486/66 PC with a double-speed CD-ROM.

Playing the movie in a different application may not give you an accurate representation of how the movie will play in your final project. For example, your Director project may take some extra CPU overhead while running – testing the movie in QuickTime Player won't warn you of the lower performance you might see in the final project. Similarly, playing the movie off of a hard drive when the final will be played off of a 2x CD-ROM won't tell you if the data rate is a problem.

NOTE*: You should be aware that some CD-ROM drives don't "like" some CD-R media. If your movies don't play well in some machines, but play fine in others, try using a different CD-ROM drive and/or different color CD-Rs.*

To test a Web movie, upload it to your server and access it with the same connection for which you are optimizing. If the Web server is on the same local area network as your test machine, you should disconnect the test machine from the LAN and access the video via the target connection, such as a modem, to simulate your target user's experience.

2: **Creating Content**

Overview of Creating Content

Creating the content involves actually shooting the video, then getting the video into the computer for editing. Other media elements, such as graphics, 3-D renders, etc. are also produced during this step, but aren't detailed in this document.

The basic video creation workflow consists of four main steps, outlined below.

1. Shooting Video for Desktop Delivery

It's important that you set up and shoot the video with the realities of the final delivery medium in mind. Use a high-quality camera and microphone, sturdy tripod and proper lighting for the best results.

3. Editing for Desktop Delivery

Once you have the video on a hard drive, you can edit and add special effects to your movie. Using simple transitions and other editing techniques can improve the final compressed movie.

2. Capturing Video for Optimum Quality

You must capture the video to get it into your computer, and like all the other steps, there are ways you can maximize your quality during the capture process.

4. Exporting and Archiving Your Movie

When you are done creating the source video, archive it for future repurposing, then export it to Media Cleaner for final compression.

Below are some general tips aimed at producing good desktop video. Most of these tips are focused on creating video that will compress well – by carefully shooting video for desktop use, you can substantially improve how well the final video will compress. Better compression results in higher-quality and/or smaller QuickTime movies.

The overall goal is to produce a video signal with the least amount of noise, camera movement and fine detail possible so that the final movie will compress effectively and look good at a small screen size.

It is critical that you shoot tests of your material and run it through your entire production process before you film the whole project. It's important to view the final results on the desktop as they will appear in the final project because your image may look great when filmed and edited, but look less than optimal after resizing and compression. Early and thorough testing will help spare you painful and expensive reshoots.

Finally, if you are new to video production, having professionals light and shoot your video may be a good idea. There is a lot of expensive hardware required to do this right, and experience is critical to producing professional results.

Use a High-Quality Camera

The higher the quality of the original video signal, the better the final QuickTime movie will look and compress.

A common misconception is that because the final movie will end up small on the screen, a cheap camera won't make a difference – this is absolutely wrong. Video noise substantially degrades compression, so a "clean" video signal produced by a professional camera will compress much better than a "noisy" signal produced by a consumer model.

A high-quality camera will help you produce superior final results

In addition to lower noise, professional cameras generally produce a sharper image with better colors given their superior optics and multi-chip design. Again, anything that improves the quality of the original video will help you deliver better QuickTime movies.

Below is an overview of the four common classes of cameras used for desktop video:

Professional (BetaCamSP, D1, studio/broadcast equipment)

The professional formats, such as BetaCamSP, generally produce higher resolution and less noise than the other formats listed here. BetaCamSP also contains adequate color information for bluescreen work.

The professional formats are not cheap – unless you are a professional videographer, you'll probably have to rent the equipment. BetaCamSP is an analog format, so you'll need to digitize the signal with a capture card to work with it on the desktop. Some of the other pro formats are digital, but not widely used for multimedia production.

DV (miniDV, DVCPro, DVCam)

DV is a high-quality digital format that integrates well with desktop systems. There are currently three DV formats: miniDV, DVCPro, and DVCam. MiniDV is the most common and generally is the format used by consumer cameras. DVCPro and DVCam are professional formats which are not as widely available as miniDV.

The DV format is far superior to Hi8, S-VHS and other consumer formats. DV is digital, so it does not suffer from generation loss – a copy of a DV tape is identical to the original. Most miniDV cameras can be connected to your computer via Firewire (IEEE 1394).

Some DV cameras offer a "progressive scan" feature. This records each frame as a single non-interlaced image, instead of two separate interlaced fields. Progressive scan source material often doesn't play as smoothly on television as interlaced material but is vastly superior for desktop delivery because it contains no interlacing artifacts. You should look for this feature when buying a DV camera and use it when filming for desktop delivery.

Consumer Formats (Hi8, S-VHS and VHS)

These consumer formats produce substantially noisier signals with lower resolution than the professional and DV formats. Hi8 and S-VHS are superior to VHS. As with BetaCam, these are analog formats and a capture card is required to get these formats into your computer.

Computer-Based Cameras (video conferencing cameras, etc.)

Generally, these cameras produce very noisy and low-resolution images. They often hook up directly to your computer, so a capture card isn't needed. We strongly recommend using a better camera if you are trying to deliver high-quality QuickTime movies.

Blue and Greenscreen

Properly executed blue or greenscreen can significantly improve your movies. For example, if you composite an actor in front of a digital still, the background image will be perfectly steady and noise-free. The lack of video noise and movement in the background improves both temporal and spatial compression of the movie, which produces a higher-quality final movie.

Green- and blue-screen work is technically challenging

However, blue and greenscreen work is very technically challenging and shouldn't be attempted unless you have the experience and equipment to do it correctly. Simply shooting an actor in front of a blue backdrop often won't work – there are very specific ways you must design your set and lighting to ensure good results. Proper testing is critical, and poorly shot material cannot usually be saved in post-processing.

NOTE: Most of the DV formats (including the pro formats) use 4:1:1 color subsampling. This is fine for most projects, but is not optimal for high-quality bluescreen work. If you need to do bluescreen, you should use a format with higher color resolution, such as Panasonic's 4:2:2 DVCPRO 50 format, or an analog pro format such as BetaCamSP.

Lighting for Compression

Generally speaking, video that is well-lit will compress better than under- or over-exposed material. Most codecs work best with moderate contrast material, and many codecs don't work as well with dark scenes. For example, Cinepak normally produces better compression with lighter images.

Adequate lighting is critical to producing superior QuickTime movies because low-light conditions produce excessively noisy video signals lacking details in the shadows. Overexposure is less frequently a problem but should also be avoided.

You should not shoot video that you know is incorrectly exposed and plan to fix it in post-processing – detail that is missing and excessive noise can never be fully corrected after the fact. Lighting your video properly is the only way to ensure the highest-quality results.

Use a Tripod and Reduce Movement

The use of a tripod often makes a dramatic impact in the quality of the final movie. This is because keeping the camera steady reduces subtle differences between frames and therefore improves the temporal compression of the video.

Be sure to use a sufficiently heavy tripod for your camera. If you plan to pan the camera during filming, use a high-quality fluid head and keep the pan smooth and slow. Irregular or "jerky" camera motion is hard to compress.

Avoid hand-held shooting if possible. If you need to film a hand-held shot, a motion stabilizer (Steadi-Cam™, gyro, etc.) will improve your results. If your camera has an image-stabilization option (either optical or electronic), you should generally use this feature to reduce subtle changes between frames from camera motion.

NOTE: Some codecs, such as Sorenson Video, are able to detect moderate camera motion and compensate for pans. However, using a tripod and maintaining smooth camera motion with these codecs will usually improve the image quality as compared to hand-held camera work.

Keep Detail to a Minimum

Keeping the detail within the scene to a minimum will help the video compress better spatially. It will also make the video easier to see when the movie is reduced in size for desktop delivery.

If you are shooting an interview, keep the background simple. Painted or plain backdrops are often a good choice. If you have the experience and equipment, blue or greenscreen can work very well for interviews.

It is fairly common to film people in front of windows. If there is much detail or movement outside, you can throw the background significantly out of focus to simplify the image.

Trees are often used as backdrops for interviews filmed outside. The excessive detail of the leaves poses a challenge for compression and should be avoided if possible. If you must film against a tree, using a shallow depth of field to defocus the leaves will often improve the final movie. Beware of trees moving in a breeze – the high detail and subtle changes between frames make both temporal and spatial compression difficult.

Ask your subjects to wear clothes that don't have high contrast patterns or lots of details. Plain colors are best – bold stripes or checked patterns can do very odd things when resized and compressed.

Producing Good Audio

Audio production values are often overlooked when creating multimedia, but are critical to professional results. As with video, your goal is to produce as high-quality and noise-free an audio signal as possible.

A professional mic produces higher-quality results.

You should use high-quality audio equipment and remote microphones whenever possible to reduce camera noise. You should try to minimize any unnecessary noise in the audio signal such as wind or street sounds (cars, construction, etc.). Shotgun mics may be useful for minimizing background noise and lavaliere mics often work well for interviews.

If you are recording voice-overs in a studio, you should use professional equipment. The mics that come with computers (both Mac and PCs) don't usually produce the audio quality of a real, professional mic. If you are recording directly into a computer, beware of hard drive noise – this is often hard to hear when recording, but will decrease the quality of the final audio signal. Many computers' built-in sound cards introduce line noise, so it is usually better to record directly through your capture card.

Once you've shot your video, you need to get it into your computer for editing and processing. Generally this is done with a capture card which turns the analog video signal into a digital file. To properly capture video, you'll need a high-quality capture card, a fast hard drive or RAID and a finely tuned system.

AV Macs have built-in digitizing boards, but for the best results you'll need a card from vendors such as Media 100, Avid or Pinnacle. Just like the camera used to shoot your video, the quality of your capture card affects the final image quality of your movie.

You must "capture" the video to get it into your computer for editing.

DV cameras already store their video in a digital format, so you don't need to digitize DV source. However, you do need to import the DV files into your computer via Firewire (IEEE 1394).

Capture Video at Full Screen

To get the highest-quality results, you should capture your video at full-screen resolution (640x480 or 720x486). Even if you intend to deliver smaller final movies, a full-screen capture will generally give you better results for a number of reasons.

A major reason to capture at full screen and scale down is that doing so tends to improve the final image. When you scale down an image, several of the original pixels are averaged to make each final pixel – this averaging tends to reduce video noise and result in a "smoother" looking image which compresses better.

Full-screen capture allows more deinterlacing options, such as blending the fields to preserve the "motion blur" effect of interlacing. If the original source was shot on film and transferred to video tape, capturing at full-screen resolution and full frame rate allows you to remove the 3:2 pulldown and return your material to its original 24 fps, which will compress better.

Most captured video has black edges around the perimeter (this is often called "overscan" or "edge blanking"). To deliver professional results, you must remove these black edges. Starting from a larger image allows you to crop and then scale the image down. If you capture at the final size that you wish to deliver your video, removing edge noise requires you to crop and then scale the video up, which degrades image quality.

Finally, if you capture and edit your material at full-screen resolution and archive the source, you can later repurpose your content to larger delivery sizes without having to re-capture and re-edit your project.

Capture with High-Quality Setting

Most capture systems have a "quality" setting. This controls how much hardware compression is used on the video during capture. Higher settings produce larger files with superior image quality. However, if you exceed the data rate your system can handle by choosing too high a quality setting, the capture card will drop frames.

Capture at the highest quality your system allows.

You should generally capture at the maximum quality your system can properly handle (this should normally be at least 3MB/sec). If you can't capture at a very-high-quality setting, you should seriously consider buying a faster drive and a fast/wide/Ultra SCSI card or possibly even a RAID. To find out the best way to capture full-screen material at a high-quality setting, contact your capture card vendor.

Capture from Master Tapes

To maintain the absolute highest-quality video signal, we strongly recommend that you digitize directly from your master tapes, not copies of the originals. We specifically recommend that you don't assemble a "rough cut" of the project on a new tape and then digitize this – since these clips are second generation, they will have more noise than the original masters.

You should also avoid "scrubbing" (fast forwarding and rewinding) through your master tapes many times. Excessive playing of the masters will degrade their quality, so you should only view the material a few times prior to capturing it. If you need to view the material several times, we recommend that you make a duplicate and view the dub instead of the master. This is particularly important with Hi8, which is a fairly fragile tape.

Audio Capture Settings

As with the video, you should capture the audio at the original quality. This is generally 44-kHz, 16-bit, stereo. We strongly recommend that you capture in 16-bit audio depth if at all possible – having 16-bit source material generally gives you more options and higher final quality, even if your final movie will be delivered with 8-bit audio.

Make sure to test your capture system before capturing all your clips. Audio levels are often different between capture and playback, so you should monitor and test your results before capturing your whole project. Capture your audio through your video capture card if possible – the built-in audio cards in most computers are lower quality than dedicated capture hardware and many introduce line noise.

Tune Your System

Getting your system properly configured to capture video can often be difficult. Below are a few general tips – please see Terran's site for more specific tips.

Generally speaking, you want as minimal a system as possible. Deactivate all unnecessary Extensions and Control Panels. Turn off Virtual Memory and any memory-enhancing programs, such as RAM Doubler™. Make sure you have the latest drivers for your capture hardware.

Capture to a fast/wide/Ultra SCSI drive that you've defragmented or just erased. Remove all unnecessary SCSI devices (scanners, ZIP drives, etc.), and turn off AppleTalk. Place a disc in all internal drives (floppy, CD-ROM, and ZIP) to prevent the system from periodically checking these drives.

Once you've got your system working well, take notes for future reference and back up your System folder. Write down any changes you make in the future in case they adversely affect your capture system.

Dropped Frames

The biggest problem while capturing video is missing or "dropped" frames. The most common cause of dropped frames is trying to capture your video at a higher data rate than your hard drive can write – as it falls behind, it starts to lose frames. Dropped frames often appear sporadically in the captured video, causing the video to randomly stutter or jerk.

Be sure to configure your capture system to warn you of dropped frames and stop capturing if you get errors. To stop dropping frames, you may need to defragment your hard drive, remove unneeded Extensions from your system, buy a faster hard drive or lower the quality (and hence data rate) of your capture.

Careful editing and effects can improve your movies

As with all the other steps in video production, how you edit and add effects to your video can affect the final quality of the QuickTime movie. Below are some general tips on optimizing your editing for desktop delivery.

Transitions & Effects

To improve the compression of your material, you should avoid elaborate transitions. Hard cuts and simple wipes are usually the easiest transitions to compress. Fades are difficult for codecs, but are often unavoidable. Complex transitions, such as page curls, pinwheel wipes and paint spatters are very difficult and will often become pixelated in the final compressed movie.

Very frequent cuts between scenes make temporal compression difficult, which is why many music videos don't compress well. If possible, try to keep the number of cuts in your piece to a minimum. Effects that add lots of minute and/or random detail to an image, such as film noise and explosions, are especially difficult to compress both spatially and temporally.

Often you don't have a choice on how a video is edited or the effects that are added, so these suggestions may be hard to implement. Fortunately, using the Developer Edition of Sorenson Video with Media Cleaner's variable bitrate (VBR) encoding can help improve the quality of difficult transitions and effects. Please see http://www.terran.com/products/SorensonVideoOverview.html for more details.

Work at Full Resolution

If you are able to capture your video at full resolution, be sure to do your editing and effects at this size. Do not resize your video with your editing or effects package. Also, be sure to render any effects with the highest quality possible. For example, After Effects offers different rendering qualities – it's fine to use lower quality for quick previews, but be sure to render the final piece at the best quality possible.

Use a High-Quality Format for Renders

If you are using After Effects to render an effect and then editing this effect into a separate After Effects or Premiere project, it is critical that you save the intermediate render file in a high-quality format.

The Animation codec at 100% is totally lossless, as is the None codec. Photo-JPEG, M-JPEG and most capture card codecs (Media 100, Avid, etc.) are almost lossless at their highest quality and will produce smaller files. Do not save your render with a distribution codec, such as Cinepak or Sorenson – doing so will substantially degrade the quality of the final project.

Correcting Problem Video

If your video has color shifts, gamma problems or other issues that you couldn't fix during shooting or capture, you should fix these problems on a clip-by-clip basis prior to editing.

It is possible to adjust colors, contrast, etc. during compression with Media Cleaner, but it's easier to do this earlier in the production process. Also, transitions such as fades between corrected and uncorrected video are impossible to fully correct after editing.

Film Source

If your material was originally shot on film and then transferred to video, you should generally return it to its original 24 fps prior to editing or adding effects. Media Cleaner's Intelecine feature can remove 3:2 pulldown from edited material, but certain types of effects and transitions will limit the effectiveness of this feature.

Once you've finished editing and adding effects to your movie, you should export the movie to Media Cleaner for the best final compression.

If you are using Adobe Premiere, you can simply export your project to Media Cleaner with the Export Module. If you are using other systems/programs for editing and effects, you'll need to save a version (either by reference or self-contained), then open this version in Cleaner for final compression. To keep your future options open, we recommend that you always render a high-quality version of your movie from your editing/effects program and archive this master for future repurposing.

Exporting from Adobe Premiere

Media Cleaner has a Premiere Export Module to simplify production.

The Export Module eliminates the need for Premiere users to save their Premiere output as a separate file prior to optimization and compression within Media Cleaner. The Export Module does this by generating a preview within Premiere and then transferring that data directly into Media Cleaner.

Media Cleaner's Export module streamlines production.

Because Media Cleaner uses the Premiere preview movies for its final compression, you must configure your Premiere presets correctly to save time and maximize your quality. Please see "Chapter 17" of the Media Cleaner Pro User Manual for details on using Cleaner and Premiere together.

Exporting from Other Systems

If you aren't using Premiere, you must save your movie as an intermediate QuickTime file prior to opening and processing the movie with Cleaner. If possible, you should output your intermediate file at full frame size and frame rate. You should also output the audio at full bit depth and rate for best results.

When you save an intermediate file, some systems allow you to save it "by reference" – this creates a small QuickTime movie which "points back" to the original sources. If your system allows you to do this, saving a file by reference is very fast, and won't take much additional disk space. However, this file is dependent on the original files, so you must not move or rename the sources.

Most capture systems also have the option of creating a "self-contained" movie. If the reference option doesn't work well for you or if you wish to create a movie that doesn't require other files, use this option to render a high-quality master. Please see the next section for more details on rendering a master.

Once you have saved your file to an intermediate QuickTime movie (either by reference or self-contained), you can open this movie within Media Cleaner for final processing and compression.

Rendering High-Quality Masters

After you have finished your editing and effects, we recommend that you render a master of the file to a high-quality, self-contained format. We generally recommend using the Animation codec at 100% quality for totally lossless files, and JPEG, M-JPEG or your hardware codec (Media 100, Avid, etc.) at a very-high-quality setting (90 - 100%) for smaller files with minimal loss.

If you use one of the "generic" QuickTime codecs, such as Animation, JPEG, or M-JPEG, you can process and compress your files on any computer that has QuickTime installed. If you use your hardware codec, you will need to install this specific codec in computers on which you wish to process the movie. Also, some of the hardware codecs aren't as reliable on systems which don't have the codec's capture hardware installed.

IMPORTANT*: Do not save your master file to a distribution codec, such as Sorenson Video or Cinepak. You should only compress your video once – for the best results, this final compression should be done with Media Cleaner Pro. The compression of your video is discussed in detail in the "Preparing Content" section of this document, starting on page 24..*

Save your file at full screen, full frame rate, and full audio quality. Unless hard drive space is a problem, do not scale your video down to the final size with your editing program – saving the full screen source will give your more options during the compression phase.

Archive Your Project!

We strongly recommend that you archive your high-quality master file, as well as your original sources and project files.

Preserving the master will allow you to easily repurpose your content in the future by simply recompressing the master. Given how fast delivery technology and Internet bandwidth is changing, there is a good chance you may want to create a different version of your project in the near future.

Preserving your raw source files and project will allow you to re-edit or alter the project if needed with minimal hassle. Also, having the original sources on hand is very convenient if you need to use the same material in a different project.

Tape drives often work well for archiving because they provide large amounts of inexpensive storage. CD-ROM drives are good options for small projects but often aren't big enough for long video sources. DVD-ROM burners should be an excellent option for archiving large source files once they become affordable.

3: Preparing Content

Overview of Preparing Content for Delivery

Preparing and compressing your movie for delivery is often the least understood step of the whole QuickTime production process. Because of this fact, the bulk of this document addresses the details of preparing high-quality QuickTime movies.

There are five major areas you should learn about in order to produce the best QuickTime.

1. Understanding Compression
Understanding how compression works can help you create movies that will compress better and therefore be higher quality and/or smaller.

2. Analyzing and Pre-Processing
You should analyze your source material and use preprocessing (such as deinterlacing and noise reduction) to optimize your movie for compression.

3. Choosing Good Compression Settings
Choosing good compression settings can be complicated. We've provided some guidelines to help get you started.

4. Taking Advantage of QuickTime's New Codecs
QuickTime has some excellent new codecs that work differently than the old standards. This section details some steps you can take to get better results from Sorenson Video and QDesign Music.

5. Using Media Cleaner Pro
Using the right compression tool is critical. This section briefly discusses how to process your movies with Media Cleaner Pro, the industry standard for high-quality QuickTime compression. We also demonstrate how to easily prepare QuickTime alternate movies with Cleaner.

Why You Need to Compress

Video, in its raw form, takes up huge amounts of space. For example, uncompressed NTSC video is about 27 Megabytes per second! At this size, you could fit only about 24 seconds of video on a CD-ROM... and no CD-ROM drive could transfer such a file fast enough to play it smoothly.

On the audio side, compression is also important, especially for Web use. For example, uncompressed CD audio is 150 KiloBytes per second, which would completely saturate a T1 connection and leave no room for video.

In order to make desktop movies feasible, compression algorithms were created. Compression is the process by which large movie files are reduced in size by the removal of redundant audio and video data. For more dramatic size reduction, less important data may also be removed, resulting in image and/or sound degradation.

The codec is the algorithm that handles the compression of your video or audio, as well as the decompression when it is played. QuickTime has several codecs available within it for free, and there are professional versions of certain codecs which may be purchased for superior quality and options.

Why Compress – both frames contain the same amount of data (2.3K)

Sorenson Video Compressed Frame
320x180 pixels, 30 fps, 70KBps
(Each frame is aprox. 2.3 KiloBytes).

With Compression

No Compression

If no compression was used, this frame
could only be 36x21 pixels (2.3 KiloBytes).
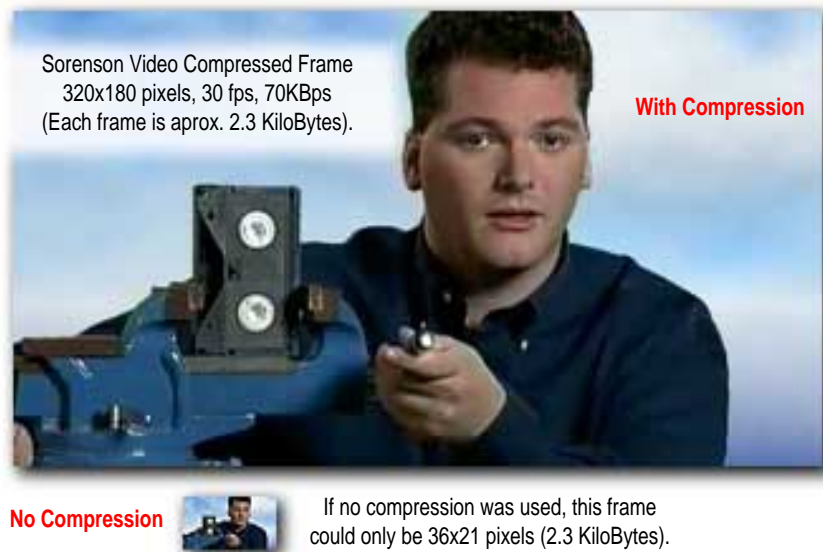
How Video Codecs Work

Most codecs compress video using spatial and/or temporal compression techniques to remove redundant data. Understanding the basics of how a codec compresses video can help you create and process your material to make the codec's job easier, which in turn will produce superior final QuickTime movies.

Spatial Compression

One method of compressing movies is to remove the redundant data within any given image. For example, in a given movie there may be areas of flat color with many identical pixels.

Instead of specifying each pixel and its color, a codec can generalize by specifying the coordinates of the area and the area's color; it doesn't have to note all the little details. This manner of reducing the size of an image is called "spatial compression."

The less detail there is in the image, the better the codec is able to generalize the image and compress it. Removing fine details in preprocessing can improve the spatial compression of an image. Video noise often looks like fine detail to a codec and should be removed to improve spatial compression. Creating video with simple backgrounds will also improve how well the final movie compresses.

How Spatial Compression Works

Areas with little detail are spatially compressed, such as those indicated above in red.

Temporal Compression

Another way to make a frame smaller is to look for changes between consecutive frames and only store the differences instead of the entire image. The original reference frame on which these differences are based is called a keyframe. Keyframes contain the entire image, and look just like a normal picture.

The frames based on the changes between frames are called delta frames, or difference frames. They contain only information for the areas that are different from the last frame and are usually much smaller than the keyframes.

How Temporal Compression Works

Keyframe   Delta frame   Delta frame   Delta frame   Keyframe   Delta frame
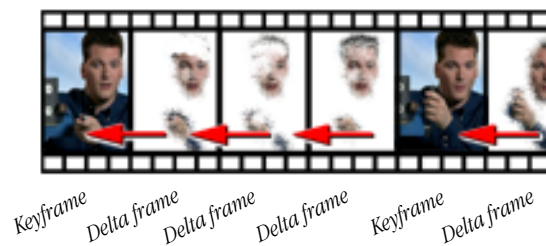
For example, the first frame of any movie is always a keyframe and contains the entire image. After this initial keyframe, there normally follows a series of delta frames. These delta frames show only the differences between the previous frame and the current frame. The delta frame wouldn't contain information on a truly static background, because it wouldn't be changing. Every second or so a new keyframe is added to correct for slight cumulative errors in the delta frames.

This kind of compression tracks changes over a period of time and is therefore called "temporal compression." Video content that changes very little from frame to frame is best suited for temporal compression. Whenever possible, you should use a tripod when filming video for desktop playback and attempt to reduce camera and subject movement. You should also avoid complex transitions and fast edits to minimize the differences between frames and improve the final compression.

Codecs in Action

The actual process of analyzing each frame and creating a compressed version is what takes so long in video compression – for each frame, vast numbers of mathematical calculations are performed to generate the final compressed frame. On a midrange Power Macintosh, it may take a couple of seconds to compress a single frame.

The codec also controls the playback of the compressed video. It's no accident that the decompression routines are usually much faster than the compression routines – this allows the frames to be decompressed fast enough to play in real-time. A frame that took a couple of seconds to compress might take less than 1/30th of a second to decompress.

Codecs that take a long time to compress but decompress quickly are known as "asymmetric." For example, the Sorenson Video codec is extremely asymmetric, which means that movies made with Sorenson Video take a long time to compress, but decompress in real-time and play smoothly.

Codecs that are intended for "live" broadcasts and video teleconferencing are usually "symmetric," meaning they both compress and decompress in the same amount of time. Fast compression and decompression is critical for real-time broadcasting. H.263 is very close to being a symmetric codec.

Because symmetric codecs don't have as long to optimize each frame during compression as asymmetric codecs, the results often don't look as good as movies made with asymmetric codecs. If you are planning to put video onto a Web site for viewers to watch "on demand," you should probably choose a high-quality asymmetric codec, such as Sorenson Video.

The Specific Codecs

There are many different codecs available within QuickTime. Most codecs have specific ranges of data rates in which they will perform well.

For example, the Sorenson Video codec produces excellent quality video at all data rates, but its high CPU playback requirements currently make version 1.0 a good fit for data rates of about 100 KBps and less. It is currently the best QuickTime codec for low bandwidth delivery, and it is widely used on the Web.

Cinepak, on the other hand, has low playback requirements but doesn't generally look good at less than 250 KBps. Because Cinepak can play on a wide range of older machines, it is often used for CD-ROM titles that must reach the biggest audience possible.

To learn more about the various codecs and understand better which ones are the best fit for your goals, please visit Terran's informational resource, Codec Central, at http://www.CodecCentral.com.

A common question new developers ask when starting to make QuickTime movies is, "What is the right formula for getting the best results?"

This question implies that there is a fixed set of steps that will work for any clip, and that's not true. The only way to get optimum results is to look carefully at your source media and apply the right pre-processing and compression settings based on the specifics of the material. This section addresses the pre-processing steps you can take to improve your material; the following sections address choosing your other settings.

One of the main things to keep in mind at this stage is that a computer screen is not a television set (nor a movie theater). If you're working with material captured from tape, you'll need to compensate for some important differences between television video and computer video.

Dealing with Interlacing

Conventional NTSC television sets are built to receive interlaced video. Each interlaced video frame consists of two images known as "fields" – each field is the even or odd lines of the image. When displaying video, a television screen draws the alternating field every 1/60th of a second. Our eyes put the two alternating fields together to create 30 whole frames per second and we don't normally notice the interlaced nature of the display.

Interlacing creates a "comb" effect that should be removed.

Because interlacing creates two unique images (fields) for each final frame and these images are 1/60th of a second apart, quickly moving areas in the video often become separated into alternating lines that look like the teeth on a comb. Interlacing works well on a TV, where the phosphors are "slow" enough to smooth out the effect, producing fluid motion and hiding the comb-like patterns of alternating lines. Computer monitors, on the other hand, use "fast" phosphors and are much sharper – the result of which is that interlacing looks horrible in multimedia projects.

If your source material is captured at half height (320x240), it only has one field, so there's no interlacing to worry about. If it's captured at full height (640x480 or 720x480), you'll want to look for interlacing. Do this by stepping through the movie one frame at a time. Watch for horizontal stripes along the leading and trailing edges of moving objects, especially those which contrast strongly with the background. If you see interlacing, you need to remove it for high-quality final results.

There are two deinterlacing techniques from which to choose. One is to blend the two fields together. This preserves motion better and can produce sharper images in some cases. However, individual frames are composed of a composite of two fields, so if you pause the movie, you'll generally see a sort of motion blur/double image in areas of motion. The other way to deinterlace a movie is to throw away the even or odd fields. This avoids the "motion blur" in still frames, but when playing the movie normally, motion may not be as smooth.

We suggest you try both techniques (Media Cleaner Pro supports both) to see which you prefer. Either deinterlacing option is preferable to leaving the video interlaced – interlacing artifacts look very unprofessional and hinder the compression of your material.

Handling Material Shot on Film

A more complicated form of interlacing occurs with material that was originally shot on film (at 24 fps) and transferred to video (at approximately 30 fps) in what's called a "telecine process." In order to make up the extra six frames per second, new frames are made by interlacing frames of the source material.

The details of this process are a bit complicated, but the end result is clear if you know what to look for. Step through the movie frame by frame and look for a pattern of three non-interlaced frames... two interlaced frames... three non-interlaced... etc. If you see this pattern, the clip has been telecined.

It's even more important to correct for telecined material than interlaced, for several reasons. First of all, it's generally possible to get back the original, non-interlaced frames perfectly, so there's no downside as with deinterlacing. Second, 24 frames per second take less data to store – and less computer power to play – than 30. Third, you're restoring the original frame rate of the movie, which will make it play a bit more smoothly.

Inverse telecine, or "3:2 pulldown removal," is performed by special filters built into programs like Adobe After Effects and Media Cleaner Pro. One advantage to Media Cleaner's "Intelecine" feature is that it automatically deals with a potential problem introduced by editing video after it's been telecined. Again, the details are a bit complex, but the result is that material which fails in the After Effects filter may come out perfectly with Media Cleaner. For more details, please see the Media Cleaner Pro manual.

It should be noted that you cannot take advantage of the inverse telecine process unless you have a full-size, full-frame-rate capture. This is yet another reason to keep your captures at the highest possible quality.

Adjusting Color, Contrast, Gamma, etc.

Computer monitors are capable of displaying a broader color range (gamut) than television screens. This allows for a more accurate reproduction of vivid colors and pure black and white. However, you're probably working with material which comes from a videotape and has thus been forced into the compromises necessary for TV. Fortunately, you can usually improve the image before compression by applying various image adjustments.

The first thing to try is increasing the contrast. The majority of video clips look noticeably better after a contrast boost. In Media Cleaner, a value of about +15 is a good starting point. Use the Dynamic Preview window's A/B slider to get it just right for your clip and often you'll find that it feels like wiping off a layer of grime you didn't even realize was there.

Boosting contrast often improves video.

While you're at it, try to restore black areas to true black, using Contrast, Brightness and/or Black Restore (not Gamma). This will improve the image quality and allow the material to compress better. You'll want to do the same for white areas.

Once you've got the adjustments set, make sure to scrub through the movie to make sure there aren't specific scenes or frames for which the changes are too extreme.

Cropping

This one's so easy, it's amazing how often it's overlooked. Televisions don't display the entire image received; an area of several pixels on each side is defined as "overscan" (also called "edge blanking") which will never be seen. Computers don't work this way, so leaving unused black borders is wasteful and ugly. Besides, multimedia video is quite often shown in a window or matted against a background, so any undesired borders will show up strongly.

All you have to do to remove the border is to click and drag in the source movie in Media Cleaner. The boxed area will be preserved, and scaled up or down as necessary. With high-quality scaling, the loss of resolution from cropping off even a generous 10% is pretty much invisible.

Noise Reduction

Reducing the fine detail in an image will help it compress spatially, which will improve the final image quality.

Video noise (which is a lot of very fine detail as far as a codec is concerned) is a major enemy of compression. Developers often use a blur filter in an attempt to reduce the noise. While this does reduce the noise and improve compression, it also softens the image, which is a different problem. Fortunately, Media Cleaner offers adaptive noise reduction, which is a much better solution.

The adaptive noise reduction filter only blurs areas of low contrast and leaves edges sharp. This gives the codec the advantages of a less noisy image but doesn't introduce noticeable fuzziness in the image. When used, this filter is often imperceptible to our eyes, but improves the final compression of the video. By default, this filter is always on in Media Cleaner's pre-configured settings – we recommend that you use this filter with all your live video.

More Details

Please refer to the "Media Cleaner Pro User Manual" for significantly more detail on using Cleaner's various filters and processing options to improve your compression.

NOTE: The Media Cleaner User Manual is another helpful online resource. You can read it at http://www.terran.com/manual/.

When compressing movies, there are many important choices to make. These choices have a profound impact on the quality of the final compressed movie, so it is important that you understand the parameters and tradeoffs involved.

Some of the more important movie options are the codec, data rate, frame rate (fps), image size and keyframe frequency. This section will give you an overview of the factors limiting your options and general guidelines in choosing your settings. Using Media Cleaner's Settings Wizard and default settings are also good ways to get started.

*Choosing compression settings
can be complicated.*

However, there is no "perfect formula" for all movies – achieving the best results requires experimentation and testing and often depends on your (or your client's) personal preferences.

Choosing the Codec

In order to choose the best codec for your movies, you must determine the minimum system requirements of your viewers.

PowerMac or Pentium required

For movies under about 100KBps, Sorenson Video is generally the best video codec choice. If you want to encode the highest-quality Sorenson Video, you may want to buy the Developer Edition to enable variable bitrate encoding with Media Cleaner.

For low-bandwidth audio, the QDesign Music codec is a good choice for most material. If you have speech-only material, the Qualcomm PureVoice codec may be a better fit. For CD-ROM and kiosk presentations, IMA may be a good choice because it takes less of the CPU's power and therefore allows the computer to decode more challenging video streams.

If you are creating a presentation for a CD-ROM or kiosk, MPEG-1 may be a good choice. However, QuickTime doesn't currently support MPEG on Windows, so for now this is a Mac-only solution.

68K Macintosh or 486 Windows Machine

The newest QuickTime codecs (such as Sorenson Video, QDesign Music, and Qualcomm PureVoice) don't run on 68K Macintoshes, and are too CPU-intensive for 486 computers. If you need to deliver video that plays well on these older computers, your best option is generally using Cinepak and IMA audio.

Choosing the Data Rate

One of the most important decisions you must make when preparing movies is choosing the data rate. More than any other factor, the data rate affects the final image and sound quality of your movie. It also affects how big the final file will be, as well as what playback methods will be able to effectively deliver the movie.

Usually there are three factors that dictate the data rate you can use on your movie: The media or connection speed, the amount of video you need to fit onto your disc and the speed of the minimum target machine. This last factor has become more significant as more CPU-intensive codecs, such as Sorenson Video, have become widely available.

Media or Connection Speed

There are many different vehicles for desktop video delivery. The most common are CD-ROMs and the Web, but DVD-ROM is becoming a reality. To get a better feel for appropriate data rates for given applications, we suggest you go through an interview with Media Cleaner's Settings Wizard to see what it recommends.

Below are some rough guidelines for data rates – we strongly recommend that you test your movies on your minimum target machine to determine its actual throughput.

CD-ROMs

Generally for CD-ROMs a total data rate of 170 - 200 KBps is safe for cross-platform 2x speed titles. A Macintosh-only product can usually be set somewhat higher, to about 220 - 250 KBps. Safe cross-platform 4x CD-ROM data rates are often around 250 - 300 KBps. Macintosh-only products can push this data rate up to about 400 - 450 KBps.

NOTE: CD-ROM drives faster than 4X often have widely varying transfer rates – sometimes the manufacturers' specifications are "burst speeds" and are not sustainable for use with movies. We strongly suggest that you test any drive before assuming it will actually give you the transfer rate specified on the box. Also, with very fast CD-ROM drives, the limiting factor often becomes the amount of video you want to place on a disc instead of the transfer speed of the drive.

DVD-ROMs

DVD-ROMs are essentially very big, very fast, CD-ROMs. Transfer speeds are usually in the 1MB per second range, and DVD-ROMs can hold from 4 - 17 Gigabytes of data. However, the larger DVD-ROM discs are substantially more expensive to press, so many developers keep their production costs lower by using the smaller discs. Even with "only" four Gigabytes of space, a 1MB/sec movie would still be a little over an hour long.

Web/Internet

There are a wide range of connections to the Web, and the volume of Web traffic at any given time substantially affects the possible throughput. Because of this fact, there is no way to guarantee the data rate your viewers will be able to see in real time. QuickTime allows you to create alternate movies so that users will get an appropriate data rate for their connection.

Generally, if you want viewers to be able to watch your video in real-time, the following numbers are reasonable starting points. If you don't mind your viewer having some delays, you can as much as double these data rates.

Web QuickTime Data Rates
28.8 Modems - 2.5 KBps
56.6 Modems - 5 KBps
ISDN - 12 KBps
T1 - 20 KBps

All data rates given in KiloBytes per second (KBps). To convert to kilobits per second (kbps), multiply by 8.

<u>Networks</u>
The bandwidth available on a local area network (LAN) varies widely depending on the type of network. We suggest you contact your network system administrator for specifications of the system. However, as a guideline, many high speed local networks can handle video in the 20 - 50 KBps range.

Amount of Video that Fits on a Disc

If you have a fixed amount of content you need to fit onto a disc, the length of the movie and the size of the disc may become the determining factors of the data rate instead of the throughput of the playback media.

The formula to determine the data rate for a movie if you know the room available on the disc and the length of the movie is as follows:

Disc space (in Kilobytes) divided by the length of the movie (in seconds) = KBps for the final movie.

To determine disc size in KBytes, take the MB of the disc and multiply by 1000. For example, a CD-ROM is 650,000 KBytes. To determine the length of the movie in seconds, multiply the number of minutes by 60. If the movie length is in hours, multiply the hours by 3600 (which is the number of seconds in an hour).

NOTE: When doing these calculations, don't forget to reserve enough space for the other components of your project. For example, your Director projector, README, installers, etc., might take 50 MB of your CD-ROM, leaving you only 600 MB for video.

For example, if you want to put two hours of video on a 4x CD-ROM and your other project files are 50 MB, the data rate you must use is about 83 KBps or less (the CD-ROM's 600,000 available KBytes divided by 7,200 seconds = 83.3 KBps). This data rate is substantially smaller than the 300-KBps data rate a 4x CD-ROM can safely handle, but it is what you must use if you want to put the two hours onto one CD-ROM. This lower data rate may not be a problem, however – Sorenson Video can deliver impressively good results at 83 KBps.

Minimum Target CPU Speed

Some of the new codecs, such as Sorenson Video, are fairly CPU-intensive. When using these codecs, the limiting factor for your data rate may be the minimum system on which you want your video to play and not the connection speed or amount of video you need to fit on a disk.

For example, the Sorenson Video codec can produce very-high-quality video at high data rates. However, as the data rate increases, the playback requirement also increases, so it's possible to produce higher-data-rate movies that won't play on your minimum target CPU.

For example, a 10 KBps Sorenson Video may play well on any PowerMac or Pentium computer (90 MHz or faster), but a 200 KBps Sorenson Video movie might require a high-speed Pentium II or Power Macintosh G3 (250 MHz or faster) to play smoothly.

Testing your material on your minimum target machine is important when using these newer, more CPU-intensive technologies. For more performance details on the various codecs, please see Codec Central at <u>http://www.CodecCentral.com</u>.

Choosing Data Rate Units

There are two confusingly similar units used for measuring data rates. Most multimedia developers are familiar with KiloBytes per second (kps, KBps or KBytes/sec) whereas many people working with Internet/network video specify files in kilobits per second (kps, kbps or kbits/sec). A Byte is eight times as large as a bit, so it is important to understand in which unit a data rate is specified.

For example, it's fairly common for developers new to Internet video to assume the rating of a modem is specified in KBps, which is wrong. A 28.8 modem transfers 28.8 kilobits per second, not 28.8 KiloBytes per second. A data rate of 28.8 kilobits per second equates to about 3.6 KiloBytes per second – a major difference from the assumed 28.8 KBps.

Choosing Frame Rate

Choosing an appropriate frame rate for your movie has a dramatic effect on video quality. Generally, higher frame rates at a given data rate will produce smoother motion with lower image quality. Lower frame rates produce sharper images with "jerkier" motion. Finding the right tradeoff depends on your material, data rate and personal preferences.

We strongly suggest that you experiment to determine the optimal settings for your movie. Using Media Cleaner's Settings Wizard can also give you a good idea of appropriate frame rates for given data rates.

You will produce smoother apparent motion if the final frame rate is an even divisor of the source frame rate. Media Cleaner supports decimal frame rates.

Ideal NTSC frame rates
30 fps (all frames)*
15 fps (every other frame)
10 fps (every third frame)
7.5 fps (every fourth frame)
6 fps (every fifth frame)

Ideal PAL/SECAM frame rates
25 fps (all frames)
12.5 fps (every other frame)
6.25 fps (every fourth frame)
5 fps (every fifth frame)

NTSC video is actually 29.97 frames per second. However, this is so close to 30 fps that you can generally treat it as 30 for the purposes of desktop video.

Choosing Frame Size

Like frame rate, choosing an appropriate frame size for your movie has an important effect on video quality. All else being equal, the higher the image size at a given data rate, the lower the resulting image quality will be.

The best size for your video is highly dependent on your data rate, frame rate, codec, source material and personal preferences. All of these factors are deeply interrelated, so experimentation is the best way to find the optimal setting for your project.

Frame Size Guidelines
Modem - 160x120
ISDN - 192x144
T1 - 240x180
CD-ROM - 320x240
DVD-ROM - 640x480 *(or 320x240 doubled)*

This chart is a very rough guideline – you should experiment to find the best setting for your project and certainly test your results to make sure they will play on your minimum target machine.

You may get better results making video at a smaller size and doubling it upon playback. For example, you might find that making an 80x60 pixel movie for modem playback and then doubling it on your Web page provides superior quality to making the movie 160x120 pixels. Again, experimentation is critical to achieving the best results.

Frame Rate and Frame Size Limitations

There are a few different factors that normally limit the frame rate and frame size you can effectively use on a project. The most common limitation is the image quality. Larger frame sizes and higher frame rates require more data to maintain acceptable image quality – if the data rate of the movie isn't high enough to accommodate the frame size and rate, the image quality will suffer.

The other common limitation of frame size and rate is the codec you are using and the CPU of the target machine. Some CPU-intensive codecs, like Sorenson Video, can produce high-quality images at high frame sizes and frame rates with reasonable data rates. However, these movies may require very high-end machines to play properly, so testing is critical.

To get a good guideline of appropriate frame rates and sizes for a given data rate, please try using Media Cleaner's Settings Wizard or take a look at the many predefined settings included with Media Cleaner. You may also find it helpful to visit Terran's online video samples at http://www.terran.com/video.

Choosing Keyframe Frequency

Like frame rate, the keyframe frequency affects the image quality of your final compressed movie.

How frequently you should set keyframes in your movie depends on the content of your movie and how the movie will be viewed. With Cinepak and normal material, one keyframe every second is usually a good rule. For example, if your movie is 15 fps, setting your keyframes to every 15 frames is probably fine. For very dynamic material, every half second often works well. For example, with a high-action 12-fps clip, you might want to set your keyframes to occur every six frames.

When using the Sorenson Video codec, a keyframe every ten seconds is usually a better setting, as this codec doesn't need nearly as many keyframes. For example, if your source is 15 fps, you should set the keyframe frequency to 150. Also, allowing the codec to insert natural keyframes as needed usually provides the best results. Setting the "Natural" keyframe slider to 50 is often a good starting point with Sorenson Video.

In some unusual cases, you may want to minimize or turn off the keyframes. This tends to work acceptably with static material which users will play straight through and not randomly access.

NOTE: Higher keyframe frequency is important for movies that viewers will randomly access because each time a movie is accessed, the current delta frame must be calculated from the nearest keyframe. If the nearest keyframe is many frames away, it can take a substantial amount of time to generate the current frame. Media Cleaner allows you to insert keyframes at specific points in your movies to improve access to these points. You should test your results to make sure your movie will play acceptably if you turn off or dramatically reduce the keyframe rate.

QuickTime offers some excellent new compression technologies for both audio and video. It's important to know how to use these new codecs properly; many developers treat them exactly like the older codecs, which often leads to disappointing results.

QuickTime's new video codec is Sorenson Video. The new audio codecs are QDesign Music and Qualcomm PureVoice. Free versions of these codecs are included with QuickTime, and you can purchase professional versions of both Sorenson Video and QDesign Music for additional controls and features. Here are some specific tips on how to use these codecs correctly.

Sorenson Video

Sorenson Video's single biggest advantage is its ability to deliver excellent-quality video at low data rates.

The first mistake people usually make with Sorenson is to give it too much data rate. Giving Sorenson Video too much data per second can "choke" the codec on playback and make it start skipping frames as it runs out of CPU power. If you're used to

Sorenson Video offers superior quality… but must be used correctly for best results.

compressing 320x240 movies with Cinepak at 200KBytes/second, try them with Sorenson Video at 100 KBps, or even 50 KBps – you may be surprised with the resulting quality.

For the best results, always use variable bitrate (VBR) encoding with Sorenson Video. This is a two-pass technique which analyzes each clip to determine which sections are the hardest, then allocates bytes as efficiently as possible. It takes longer and requires both Sorenson Video Developer Edition, and Media Cleaner Pro, but it's worth it. Some clips can retain their quality at half the data rate they'd otherwise require, and transitions, in particular, tend to look much better at low data rates. As a point of comparison, nearly every major DVD-Video title released uses variable bitrate MPEG in order to get the best results – VBR is a really good thing.

Temporal compression is a real strength of the Sorenson Video codec. Movies with relatively low motion (such as "talking head" clips of interviews, etc.) can compress extremely well. Also, doubling the frame rate does not usually require doubling the data rate for comparable image quality.

Sorenson Video takes more computing power to get a pixel to the screen than Cinepak. So it's important to be realistic about frame sizes and frame rates. 320x240x15fps will play fine on almost all new PowerMacs and Pentiums, while 640x480x30fps won't even work on a 300MHz system. On the bright side, Sorenson-compressed movies scale up much more smoothly than Cinepak. Try doubling 320x240 to fullscreen for impressive results on fast PowerMacs.

Another way to keep the pixel rate lower is to take advantage of wide-aspect-ratio movies. A theatrical trailer shot in 16x9 aspect ratio, properly cropped and Intelecine'd to its original 24 fps has almost half the pixel rate it would if left at 320x240x30fps... but will look even better.

In some cases, it's worth making two versions of a movie: One high-end version for viewers with fast hardware and

another smaller version for those with older systems. This allows you to deliver a truly outstanding experience to the power users (who have the highest expectations) and still be compatible with the rest of the world. And given Sorenson Video's small file sizes, you can often fit both versions into less room than a single Cinepak version.

Tips: always make your movies a multiple of four pixels in both dimensions. This allows Sorenson Video to use hardware acceleration for better results when it is available. Also, be wary of bright saturated colors, especially primary red. They tend to "smear" a bit regardless of how much data you give the codec. Avoiding saturated colors in lettering is especially important.

For more tips on using Sorenson Video and the special features of the Developer Edition (such as enhanced watermarks, media keys, and more) please see http://www.terran.com/products/SorensonVideoOverview.html .

QDesign Music Codec

As the name suggests, this codec is well-optimized for compressing music, or audio content which includes music. It's possible to stream 44-kHz stereo material over a 28.8 modem and provide a very satisfying listening experience. It's important to note that the results depend on your material. Purely instrumental music compresses much better than complex vocal music.

Unlike most QuickTime audio codecs, QDesign Music lets you pick the data rate, much like a video codec. A general rule of thumb is to use about 1 kilobit per kilohertz. For example, a 22-kHz track would take 22 kbits/sec, or roughly 2.5 KBytes/sec. Purely instrumental music can often sound good at half or a quarter of a kilobit per kilohertz. And stereo generally requires about 25% to 50% more data rate than mono. Of course, the more data rate you provide, the better it will sound.

QDesign produces the best result on audio which never exceeds about -3db (or 70% of full scale). While the codec itself provides features to limit the input, you can often achieve better results by normalizing the entire input signal to 70% – Media Cleaner makes this simple.

Like Sorenson Video, QDesign Music uses a fair amount of CPU power to achieve its impressive levels of compression. The amount of CPU it uses is proportionate to the sample rate of the signal and doubles with stereo. A 44-kHz stereo soundtrack can use up more than half of the CPU power of a low-end Pentium or PowerMac.

Because of this fact, it's important to have realistic expectations for what can be achieved on low-end systems. Also, it doesn't generally make sense to use QDesign Music on movies of more than about 100 KBytes/sec because the CPU is often "tied up" with playing the video and placing an additional load on the CPU with this codec may cause sync loss or dropped frames.

QUALCOMM PureVoice

This codec is designed to provide good voice quality at extremely low bitrates. If you want to stream a "talking heads" movie over a modem, this is definitely your choice. Even a 14.4 modem can deliver an intelligible narrative.

However, you shouldn't generally use this codec on music or material which contains a lot of non-vocal effects. PureVoice tries to model everything as speech, so a piano or race car may sound odd if it's compressed with this codec. PureVoice is typically used at 8khz but can be used at higher sample rates for larger, higher-quality files.

A big part of getting the best results in any process is using the right tools. This is especially true in processing and compressing QuickTime movies.

Many developers new to video compression make the mistake of simply using their editing software to output final compressed video. While this works, it doesn't usually produce the highest-quality results because editing programs provide limited compression options and don't support advanced features such as variable bitrate encoding. Similarly, QuickTime Player is an essential general QuickTime application, but isn't the best tool for producing compressed movies.

To get the best results, we strongly recommend using Media Cleaner Pro for your final QuickTime compression. Cleaner is totally focused on providing you with the best processing and compression, which is why it has won numerous awards and top reviews. Media Cleaner's great results continue to be the reason why Apple, Adobe, Digital Origin, Media 100, Avid and other companies recommend and/or bundle Media Cleaner for media compression.

About Media Cleaner Pro...

Media Cleaner works with your existing tools and includes an Adobe Premiere Export Module to streamline your workflow. Cleaner is easy to use and has a friendly Settings Wizard for people new to video. Media Cleaner Pro also provides total manual control over all the processing/compression options and allows you to batch process up to 2,000 files at a time.

To learn more about Media Cleaner and download a free demo, please visit the Media Cleaner page. You can also review the online Cleaner manual. If you are interested in purchasing Media Cleaner, please visit our Online Store at http://www.terran.com/sales or call Terran at (800) 577-3443 x1 or +1 (408) 356-7373 x1.

Using Cleaner to Produce QuickTime Alternates Movies

If you want to deliver the best online QuickTime, you should generally use alternate movies. QuickTime's alternate movie feature allows you to create multiple versions of a movie and set criteria for when the various versions should be displayed. This allows you to deliver movies with different data rates or codecs to users based on their connection speed or other factors.

Media Cleaner is the only tool that makes alternate movie production simple. This section outlines how to make a movie that has a 56K modem version, an ISDN version, a T1 version and a still image for viewers with older versions of QuickTime. Depending on the viewer's connection, they will automatically be shown the version of the movie with the most appropriate data rate. For more information on alternates and fallbacks, please see the Media Cleaner Pro Manual.

Using Cleaner to Produce QuickTime Alternates Movies (cont.)

1. Getting Started

To begin, launch Media Cleaner and create a new batch with the File menu. The Process window will now be empty. Drag your source movie onto Media Cleaner's Process window. A small icon of the movie will appear.

2. Crop and Trim the Source

View the original movie by double-clicking on the icon or name of the movie in the Process window. When the movie opens, click and drag on it to set a cropping rectangle. You can also move the movie controller to the points at which you want the clip to begin and end and use the "Set In/Out Points" command from the Edit menu to trim the movie. When you are done, close the Source window.

3. Choose your Settings

Make sure the Setting Pop-up at the bottom of the Process window is set to "Advanced" then double-click on the blank setting column next to your movie's name. This will open the Advanced Settings dialog.

Open the toggle next to "QuickTime WWW" in the Setting list on the left. You will see several different default settings for making alternate movies. Hold down the "Shift" key and select:

QT4-realtime 28.8
QT4 realtime 56K
QT4-realtime Dual ISDN

and in the "QT 2 compatible" folder:

QT Still Fallback
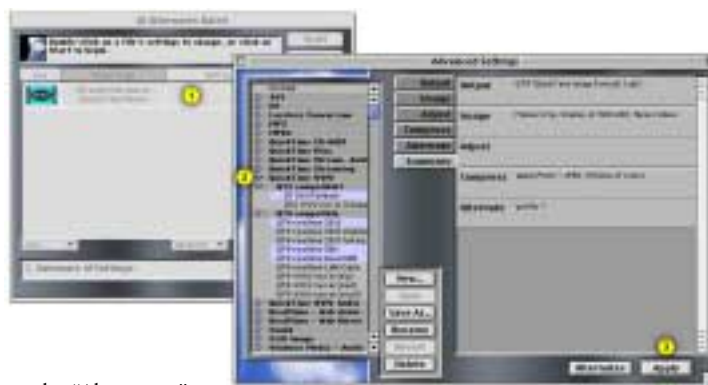
When all of these settings are highlighted, press the "Alternates" button at the bottom of the window to apply them. The Advanced Settings dialog will close, and your source movie is now listed four times (once for each new setting). The blue bar connecting your movies shows that they are all part of the same alternate group.

Using Cleaner to Produce QuickTime Alternates Movies (cont.)

4. Process your Movies

Press the "Start" button to begin processing your movies. Cleaner will prompt you for a destination for the final files, then begin compressing the movies. During compression you can use the "Before/After" slider in the output window to compare the original movie to the final compressed results.

When Cleaner is done processing your alternates, it will put them in a folder named after the source movie. In our illustrated example, the source movie is called "DirectorSite Source." Cleaner will create a folder called "DirectorSite_Source" which will contain:

"Director.mov", "Direct00.mov", "Direct01.mov", "Direct02.mov"

These files and folders are automatically named so that they will work correctly on most Web servers. The movie without the numbers after its name is the "master movie" and contains the fallback still image. Viewers without QuickTime installed will see this movie. The numbered movies are the alternate versions that will be played according to the viewer's connection speed.

5. Embed and Upload the Movies

Use your HTML editor to embed the master movie as you would embed any other QuickTime movie. You don't need to embed the alternates – as long as you don't rename the alternates and leave them in the same folder as the master movie, the QuickTime Plug-in will automatically find them.

Upload the folder of alternate movies to your server, and test your page. You will see the appropriate version of your movie according to your QuickTime Plug-in settings.

To configure your QuickTime Plug-in settings, press the right-most button on the movie controller under a movie within your Web browser. Pressing this downward pointing triangle button will display a pop-up menu with several options – select the "Plug-in Settings" to configure the QuickTime Plug-in. You can also set the connection speed by opening the "QuickTime Settings" control panel, selecting "Connection Speed" from the pop-up and choosing the type of connection your computer has to the Internet.

NOTE*: You don't have to set the connection of the Plug-in to your actual connection speed – you can set it higher or lower to test your movies.*

4: Authoring

Most projects require that your final compressed media be integrated into some sort of presentation. This can be as simple as a movie embedded in a Web page, or as complicated as a totally immersive Myst-like world. There are several approaches, depending on the complexity of your project. Here are a few examples of the more common authoring techniques.

Embedding Movies in Web Pages

A simple <EMBED> tag is all it takes to include a QuickTime movie in a Web page. This works great for demos, introductions and movie trailers. An audio-only movie can be embedded to provide a soundtrack to your Web page.

Many of the new HTML tools, such as Adobe GoLive, can automatically embed QuickTime movies in your page. When you compress your movies with Media Cleaner, it can also create the <EMBED> tags for you. Or you can write the tags by hand since the syntax is fairly simple.

For more details about the syntax of QuickTime <EMBED> tags, drop by
 http://www.apple.com/quicktime/authoring/embed.html

Wired QuickTime Movies

QuickTime adds the ability to create "wired" (interactive) movies. Wired movies can include buttons which jump to another point in the movie, go to a URL, or provide a custom controller. By using background pictures, you can make a small movie look much bigger. And it's possible to include URL links back to your Web site on movies which are widely distributed.

The best part about wired QuickTime movies is that they don't require additional plug-ins, and they work either online or on a CD-ROM. Electrifier Pro and Totally Hip's LiveStage are currently the tools of choice for authoring wired QuickTime movies.

Electrifier is an easy-to-use tool that supports many interactive options. For more details about Electrifier, and sample movies, check out
 http://www.terran.com/products/ElectrifierOverview.html .

Electrifier Tips: Make sure all your video tracks' upper-left coordinates are a multiple of four in both dimensions. Also, make sure nothing overlaps any of your videos, and that your video tracks are not on top of a sprite track.
LiveStage is a powerful, script-driven application which enables very complex interactivity.

Developers familiar with scripting languages such as Director's Lingo and AppleScript can generally pick up LiveStage's QScript quickly. If you are unfamiliar with scripting, learning it can take a significant amount of time.

For more details about LiveStage, and sample movies, check out
http://www.terran.com/products/LiveStageOverview.html

Interactive Projects with Director

The majority of interactive multimedia titles for the last several years have been authored with Macromedia Director. It is possible to create extremely sophisticated projects with this tool, though learning to use Director can be challenging.

When including movies in Director projects, there are a number of important steps to remember. A movie which may play fine by itself in MoviePlayer may not play as well when incorporated in a Director project, due to the overhead of having other things going on at the same time.

While movies are playing, keep all other actions to a minimum, and look carefully at your Lingo to make sure there isn't too much going on during playback. Also, make sure that movies are being played "direct to stage", that their upper-left coordinates are a multiple of four in both dimensions, and that there isn't a single pixel of anything else on top of them.

4: Delivery

Once you've finished producing your final project, you need to deliver it to your viewers. The major ways that developers typically deliver projects are outlined below.

NOTE: We strongly recommend that you test your project prior to giving it to your client or making your site available to the public. Please see "Planning the Project" on page 11 for more details on how to test your projects.

There are several different ways to deliver your final QuickTime movies.

Online Delivery

QuickTime enables progressive download (AKA "http streaming"), so you don't need special servers or protocols to deliver your movies. Simply upload your movies to your Web server the same way you upload graphics. You can use HTTP or FTP for accessing movies.

If you are using alternate movies, upload the whole folder of alternates that Cleaner created, and don't rename or move the alternates outside of this folder. For more details on alternates, please see the Media Cleaner Pro User Manual.

If your site will be experiencing high traffic, you may want to move your QuickTime movies to a different server to prevent your primary Web server from becoming overloaded. Because QuickTime movies are currently treated as files, it is easy to store movies on a secondary site.

For example, Terran places many of our movies on a series of third-party FTP sites. This allows us to keep our primary Web server focused on serving the HTML of our pages, and not get overloaded with large movie files. Because we have different ISPs serving these files, we also have much greater bandwidth than if we served all of them from our primary Web server.

For more information about putting QuickTime online, please visit Apple's site at http://www.apple.com/quicktime/authoring.

CD-ROM Delivery

If you will be producing a CD-ROM containing your movies, you'll need to create a CD master to give to your software duplicator. Or, if you only need to distribute a limited number of CD-ROMs, you can burn these yourself with a CD-R (recordable CD-ROM) drive.

In order to create your own CDs, you'll need a CD-R drive, CD-ROM mastering software such as Adaptec Toast™, and blank CD-R media. The good news is that all of these items have dramatically come down in price the last few years, and media is now very cheap.

CD-R issues

Certain CD-ROM drives have a hard time reading some CD-R media. This can cause movies stored on a CD-R to "stutter" or lose audio sync because the CD-ROM drive isn't able to read the movie data fast enough to "keep up" with the movie during playback.

CD-ROM drives were originally designed for standard, silver CDs if you look at CD-R media, you'll see that it's not nearly as reflective as normal CD-ROM discs. Because of the difference in media, certain CD drives may play one color of CD-R media fine, yet have problems with other colors. For example, some developers have better luck with gold CD-R media as compared to green media.

If you have trouble with movies which play fine off your hard drive, but not from your CD-R, try playing these discs in a different CD-ROM drive. You may also get better results by switching media (be sure to use a different color), or by using a different CD mastering program, or a different CD-R burner.

DVD-ROM Delivery

Burning a DVD-R disc is very similar to burning a CD-R. To do this, you'll need a DVD-R drive, mastering software, and blank media.

At the time this document was written, DVD-R drives were extremely expensive, but rapidly coming down in price. Hopefully they will become affordable in the near future. Their immense size (4+ Gigabytes) makes DVD-ROM an ideal medium for QuickTime movies.

NOTE: *DVD-Video is different than DVD-ROM. DVD-Video is a specific format intended for playback on set-top players and allows for interactivity. Creating DVD-Video requires that your movies are compressed with MPEG, and properly prepared and mastered with a DVD-Video mastering application. DVD-Video is outside the scope of this document.*

Kiosk/Presentation Delivery

If you are presenting your movies to viewers directly from your computer or placing them on a computer within a kiosk, you can simply copy your files to the final drive. For optimal playback, you should defragment your hard drive. If your movies are encoded with a hardware codec, you must install the capture hardware in your system for optimal playback. Similarly, if you are presenting MPEG-2 movies, you will need a hardware card to support proper playback

Tools and Resources

Professional QuickTime Tools and Codecs

Media Cleaner® Pro

Media Cleaner Pro is the industry standard for high-quality QuickTime compression. Top professionals use Media Cleaner to prepare great video, audio, and still images for delivery on the Web, CD-ROM, DVD, kiosk and intranet. Media Cleaner is easy to use and gives you total control over your compression parameters.

Sorenson Video™

The Developer Edition allows you to produce unmatched quality low-bandwidth QuickTime video. When combined with Media Cleaner Pro, the Developer Edition gives you access to several important advanced features, including variable bitrate encoding, enhanced watermarking, and media keys to protect your video.
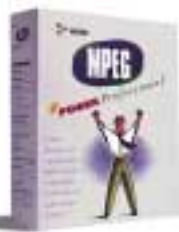
MPEG Power Professional™

The award-winning HEURIS MPEG Power Professional gives you total control over your MPEG encoding within Media Cleaner Pro. Batch process, change bitrates and aspect ratios, inject I-frames, remove 3:2 pulldown, and much more. MPEG-1, MPEG-2, and MPEG-2 DVD versions available.

QDesign Music Codec™

This is a high quality, low-bandwidth QuickTime audio codec. It does an excellent job on instrumental music, allowing very high quality even over a 14.4 or 28.8 modem. This codec is also very good for vocal music. Get the Professional Edition for faster encoding, more data rates, and additional controls.

Professional QuickTime Tools (cont.)

Electrifier Pro®

Electrifier Pro is an easy-to-use interactive QuickTime authoring tool. Use Electrifier to enhance your site with a wide range of content – animation, audio, video, 3D, VR, and over 150 special effects... all within QuickTime! Electrifier's timeline interface makes authoring easy for developers familiar with other authoring tools, such as Director.

LiveStage™

LiveStage is a powerful, interactive QuickTime authoring tool. If you're familiar with scripting languages such as Lingo, and want to create complex interactive media, then LiveStage is the tool you need. Totally Hip's QScript scripting language gives you full access to all the capabilities of QuickTime Wired Sprites – including control of 3D, VR, and all other QuickTime media types.

Sorenson Broadcaster™

Sorenson Broadcaster is the first live audio and video broadcasting tool created for use with Apple's QuickTime 4. Designed for the Macintosh platform, the Broadcaster compresses low bandwidth audio and video in real time and streams it live on a variety of networks - from local or wide-area networks to the Internet.
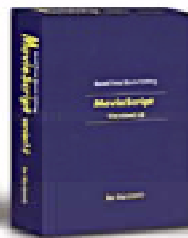
MovieScript™

Use MovieScript to automate your repetitive movie production tasks, such as appending trailers, changing copyrights, creating custom movies, and much more! With MovieScript, you can now use AppleScript to create highly customized QuickTime solutions without writing any C++ code.

Online QuickTime Resources

Codec Central
Terran's online educational resource that lists all the codecs and provides samples of each. Also includes more in-depth articles.

http://www.CodecCentral.com

Terran Interactive's Site
A good source of information on QuickTime and related topics.

http://www.terran.com

Terran's Online Videos
See what carefully encoded online QuickTime movies look like. Includes links to more movies.

http://www.terran.com/video/

Apple's QuickTime Homepage
Apple's official site is an excellent resource for information, tools, and the latest versions.

http://www.apple.com/quicktime/

Judy and Robert's Little QuickTime Page
This is a very useful publication focused on the latest QuickTime news.

http://www.bmug.org/quicktime/

QUICKTIME-DEV List
This is a great list if you're a QuickTime developer. Use Apple's mailing lists page to join at:

http://www.lists.apple.com/

Glossary of Multimedia Terms

16:9 Aspect Ratio – a standard display aspect ratio of DVD-Video. When displayed on a normal television (which is 4:3), 16:9 material will be "letterboxed" with black bars at the top and bottom of the screen.

16-Bit – color depth which allows thousands of colors to be displayed simultaneously. Also called "Thousands of Colors" on the MacOS.

2.21:1 Aspect Ratio – see "Cinemascope"

24-Bit – color depth which allows millions of colors to be displayed simultaneously. 24-bit images can be truly photographic in quality. Sometimes referred to as "true color" and called "Millions of Colors" on the MacOS.

3:2 Pulldown – conversion of film frame rate material (24 fps) to NTSC video (29.97 fps) which results in the addition of approximately six frames per second. Pulldown frames are created by blending frames from the original source in a specific pattern, and is very undesirable in compressed movies. Pulldown is introduced with a machine called a "Telecine", and may be removed with Media Cleaner's "Intelecine" feature.

4:1:1 Color – moderately compressed video color subsampling in which the luminance channel is not subsampled, but the chrominance channel has one quarter the resolution. Standard color space for DV.

4:2:0 Color – moderately compressed video color subsampling that is very similar to 4:1:1. Color space used by MPEG.

4:2:2 Color – mildly compressed video color subsampling in which the luminance channel is not subsampled, but the chrominance channel has half the resolution. Often used in professional editing.

4:3 Aspect Ratio – a common display aspect ratio. 320x240 is a 4:3 aspect frame size.

4:4:4 Color – uncompressed video color which has no subsampling

8-Bit – color depth which allows 256 colors to be displayed simultaneously. The colors that will be displayed at a given time are specified in the "Palette". Many older computers only have 8-Bit displays. Also called "256 Colors" on the MacOS.

Adaptive Noise Reduction Filter – "intelligent" noise filtering system that analyzes each pixel and applies an appropriate filter to remove the noise. Normally maintains edge detail while still improving compression.

ADSL – **A**symmetric **D**igital **S**ubscriber **L**ine. A new high-speed Internet connection technology which enables high speed connections over existing telephone lines. ADSL is not widely available to the general public as of this writing, but many believe it will be very popular for Internet access in the next few years.

Alternate Movies (aka "Movie Alternates") – QuickTime option which allows you to create multiple versions of a movie and set criteria for when the QuickTime Plug-in should display the various versions.

Alpha Channel – an additional image channel which is often used to store transparency or compositing information. Alpha channels are often 8-bit, but some applications support 16-bit alpha channels. Only certain formats, such as PICT and the QuickTime Animation codec, support alpha channels.

Analog-to-Digital Converter (A/D) – chip which converts analog video signals to digital signals. Analog-to-digital converters are used on capture cards to change the video into a format that the computer can better manipulate and store.

Architecture – see "Multimedia Architecture"

Asymmetric Codec – codec which takes longer to encode then decode. For example, Sorenson Video is extremely asymmetric because it takes many times longer to encode a video frame than it does to play back the same frame.

B-frame (bi-directional frame) – A B-frame is an MPEG difference frame which is based on both the previous and next frame. Similar to a QuickTime delta frame, only with the ability to see what's ahead.

Bandwidth – amount of information that can be sent, processed, etc., in a given amount of time. For example, a double-speed CD-ROM drive has a maximum bandwidth of 300 KBps; a 28.8 modem has a theoretical bandwidth of approximately 3 KBps.

Batch Compression – grouping two or more movies together to be compressed sequentially, so that each compression doesn't need to be started manually.

Binhex – MacOS encoding scheme which converts normal computer files into ASCII (text) characters for transmission over the Internet. Binhex'd files normally end with ".hqx", and must be returned to their binary format prior to use.

Bit – **Bi**nary Digi**t**. A unit of measure for computer data. A bit is a single computer digit (either a "1" or a "0"). Eight bits makes a Byte, which is a single character in most languages.

Bitmap – collection of pixels that make up an image. Often used to distinguish images which are pixel based as compared to images which are vector based.

Blur – filter which averages together pixels to soften the image, and can be used to minimize subtle frame-to-frame differences. Normally when compressing movies, you will get better results with Media Cleaner's Adaptive Noise Reduction filter.

Bottlenecks – points in a system that are slower than the rest of the system, causing overall delays. In the Internet, bottlenecks are often caused by localized problems, such as overloaded switching complexes, slow modems, etc.

Broadcast – used to refer to signals intended for delivery over the television system, as well as network delivery to a wide audience.

Burn – changing a text or sprite track into an image in the video track. Often used as a work-around to the fact that QuickTime for Windows 2.1.2 does not support text or sprite tracks.

Byte – computer data unit, which represents a single character for most languages. One Byte is made up of eight bits.

Cable Modem – a special modem designed to operate over cable TV lines to provide extremely fast access to the Internet. As of this writing, availability is limited, but expected to increase in the next few years.

CCIR601 – standard resolution specified by certain formats, including DV. CCIR601 can be 720x486 or 720x480.

CD-ROM – **C**ompact **D**isc - **R**ead **O**nly **M**emory. A ubiquitous delivery medium used for distribution of computer software, particularly multimedia.

Cinemascope – very wide (2.21:1) aspect ratio which is one of the standards in MPEG-2. When displayed on a normal television, Cinemascope material requires pronounced "letterboxing" (black bars on top and bottom).

Cinepak – commonly used codec for CD-ROM video compression. Allows temporal and spatial compression, as well as data rate limiting. Newer codecs, such as Sorenson Video, offer superior image quality and features, but Cinepak is still used for backwards compatibility.

Chapter List – QuickTime feature which allows users to click on a pop-up to display the first text track of a movie. Selecting text from this pop-up shows the viewer the part of the movie associated with the selected text.

Chrominance – the color component of an image.

CLUT – abbreviation for Color Lookup Table. See Palette.

CMYK – **C**yan **M**agenta **Y**ellow Blac**k**. Color space commonly used for images which will be printed with 4four-color ink on offset presses.

Codec – also called a compressor. A codec is a compression/decompression software component which translates video or audio between its uncompressed form and the compressed form in which it is stored. Sorenson Video and Cinepak are common QuickTime video codecs.

Codec Central – section of Terran Interactive's web site which contains current information and pricing on the various codecs and multimedia architectures. To get there, select "Codec Central" in the Media Cleaner Internet menu, or visit http://www.CodecCentral.com .

Color Depth – possible range of colors that can be used in a movie or image. There are generally four choices with video: Grayscale, 8-bit, 16-bit, and 24-bit. Higher color depths provide a wider range of colors, but require more space for a given image size.

Color Lookup Table – see "Palette"

Color Space – mathematical model which describes colors. Common models include RGB, CMYK, HSV, and YUV. Also called "Color Model".

Color Subsampling – method of reducing the size of an image by storing color data with lower resolution than luminance data. Typically used in video with the YUV color space. Common subsampling options include 4:2:2, 4:1:1, and YUV9.

Color Table – see "Palette"

Compression – the process by which files are reduced in size by the removal of redundant or less important data. See also "Lossy" and "Lossless".

Compressor – see "Codec"

CPU – **C**entral **P**rocessing **U**nit. The processor chip(s) in a computer. Often used to refer to a computer in general.

CPU-Intensive – describes processes which use large amounts of processor power. CPU-intensive processes tend to tie up the computer while they are running, and not work well on slower machines.

Data Rate – amount of information per second used to represent a movie, often expressed in KBps (KiloByte/sec). A single speed CD-ROM movie is usually made at a data rate of 100 KBps, and a double speed CD-ROM movie about 200 KBps. The data rate of uncompressed NTSC video is about 27 Megabytes per second.

Data Rate Spikes – short sections of a movie that have significantly higher data rates than the rest of the movie. If not properly managed, spikes may cause dropped frames or other problems at certain points of the movie.

Decode – in multimedia, this term refers to decompressing a compressed (encoded) file so that it may be displayed. Codecs do this decoding while the video/audio is played.

Deinterlace – to remove the interlacing artifacts caused by the two-fields-per-frame nature of video.

Delta Frames – frames which contain only the changes from the previous frame. Delta frames are created by codecs which use temporal compression. Delta frames are also called "difference frames."

Difference Frames – see "Delta Frames"

Dial-up Modem – computer device that connects users over phone lines to another computer or network. Currently the most common consumer internet connection, modems are much slower than other options, such as ISDN and T1 connections.

DirectShow – (formerly known as ActiveMovie) the successor to Microsoft's Video for Windows architecture.

Dongle – hardware copy protection device. Usually a dongle plugs into the ADB, USB, or serial port of the computer, and the protected software won't run unless the dongle is present.

Download – to copy a file from a server or network to your machine.

DVD – standards-based media format, which is intended to replace CD-ROM, VHS, and audio CDs. DVD discs look much like a CD-ROM or audio disc, but use higher density storage methods to significantly increase their capacity. There are different uses of the DVD media – see "DVD-ROM" and "DVD-Video" for more details. (The "DVD" acronym doesn't have a specific meaning anymore – it was originally short for "**D**igital **V**ideo **D**isc", but then DVD expanded beyond just video. Sometimes explained as "**D**igital **V**ersatile **D**isc.")

DVD-ROM – version of the DVD disc format for computers which is expected to replace CD-ROMs. Similar to a fast (8x), large (4 - 17 Gigabytes) CD-ROM, DVD-ROM can hold any type of computer data, and does not require MPEG.

DVD-Video – version of the DVD disc format used for storage of prerecorded movies which is expected to replace VHS. DVD-Video specification uses MPEG.

Dynamic Preview – Media Cleaner feature which lets you see the effects of your processing and/or compression settings.

Edge Blanking – black part of the video signal that normally falls outside the area that shows on a TV screen. Most capture cards include some amount of edge blanking around the captured image. Commonly referred to as "edge noise" or "overscan".

Embed Tag – HTML code that specifies how a graphic or movie will be included within your WWW page.

Encode – in multimedia, this term means compressing a file. See "Compression"

Export Module – plug-in for Adobe Premiere™ which allows files to be transferred from Premiere to Media Cleaner for optimization and compression.

Fallback – alternate movie, image, or text message displayed to viewers who don't have QuickTime installed.

Fast Start – progressive download feature of QuickTime which allows movies to be viewed inline before the whole movie has been fully downloaded.

Field – half of an interlaced video frame consisting of the odd or the even image lines. Alternating video fields are drawn every 1/60th of a second in NTSC video to create the perceived 30 frames per second video.

Firewall – a network device which may be configured to limit unauthorized entry or use of a private network. Often firewalls create issues with streaming media delivery, especially with formats using protocols such as RTSP.

Flat Field Noise – slight differences in areas that should be identical, for example, "blotchiness" in the background behind a title. Although often not objectionable to the human eye, "flat field" noise degrades compression and may be removed with the Adaptive Noise Reduction filter.

Flattening – final pass applied to a QuickTime movie, which ensures that the movie data is laid out in a completely linear fashion, and all external references are removed. It also ensures that the sound is interleaved properly with the video.

FPS – **f**rames **p**er **s**econd, a measure of the frame rate of video or film. NTSC video is 29.97 fps, PAL and SECAM video is 25 fps, and film is 24 fps.

Frame – one single still image among the many that make up a movie. A video frame is made up of two fields. A film frame is a single photographic image, and does not have separate fields.

Frame Rate – number of frames per second of a movie.

FTP – File Transfer Protocol. A common Internet protocol used for transferring files between computers. Often used for downloading files, such as updaters.

Gamma – curve that describes how the middle tones of images appear. Often incorrectly referred to as "brightness" and/or "contrast," gamma is a non-linear function. Changing the value of the gamma affects middle tones while leaving the white and black of the image alone. Gamma adjustment is used to compensate for differences between Macintosh and Windows video cards and display.

Gamut – the range of possible colors within a given color space. For example, the gamut of NTSC is dramatically more limited than the gamut of the RGB color space.

Generation Loss – image degradation that occurs each time a movie is saved with a lossy compression codec. Also occurs in each dub with analog video tape.

GIF – **G**raphics **I**nterchange **F**ormat. A bit-mapped graphics file format which supports images up to 256 (8-bit) colors. The GIF format is widely used online and works best with illustrations with areas of flat color. (JPEG is a better option for photographic images.)

GOP – **G**roup **o**f **Pi**ctures. A self-contained sequence of MPEG frames starting with an I-frame, followed by B and P-frames, and ending with a P-frame.

HHR – **H**alf **H**orizontal **R**esolution. MPEG-2 files may be stored at half normal horizontal resolution to create lower data rate files. When displayed, the video is normally "stretched" by the MPEG player to full resolution.

HSV – **H**ue **S**aturation **V**alue. Color space which defines colors in terms of their hue (the color of an object, such as green), saturation (how much grey is in the color), and value (the lightness or darkness of the color). Variations on this color space include HSB (Hue Saturation Brightness) and HSL (Hue Saturation Lightness).

HTML – **H**yper**t**ext **M**arkup **L**anguage. The programming language the World-Wide Web uses to display pages, links to other pages, etc.

HTTP – **H**yper**t**ext **T**ransfer **P**rotocol. The most common transfer protocol used on the Web.

HTTP Streaming – see "Progressive Download"

I-frame (intraframe) – complete MPEG frame containing the entire image. This is the same thing as a "keyframe" in QuickTime/AVI. See "Intraframe"

IMA – 4:1 compression audio codec which works with 16-bit audio. Based on the standard created by the Interactive Multimedia Association.

Indeo™ – codec developed by Intel, which allows temporal and spatial compression as well as data rate limiting for use on CD-ROM projects.

Inline – within the browser page, as opposed to needing to be viewed with an external application.

Intelecine™ – Media Cleaner's inverse telecine process which intelligently removes the 3:2 pulldown frames added to movies when 24 fps film source is converted to 30 fps video.

Interframe – temporally compressed frame. Also called a "difference" or "delta" frame in QuickTime. MPEG has two types of interframes – "B-frames" and "P-frames."

Interlaced Video – each NTSC or PAL video frame consists of two "Fields". When displaying video, an NTSC television draws the alternating fields every 1/60th of a second, and PAL televisions display the alternating fields every 1/50th of a second. Our eyes put the two alternating fields together to create 30 whole NTSC frames per second (or 25 whole PAL frames). Because interlacing creates two unique fields for each final frame, and these images are 1/60th or 1/50th of a second apart, quickly moving areas in the video often become separated into alternating lines that look like the teeth on a comb. This effect is undesirable for desktop video, and should be removed (deinterlaced) prior to compression.

Interleaving – QuickTime and AVI term which refers to intermixing the video and audio data in the final file. Interleaving is required for proper playback of movies, because it allows the drive to read the file in a linear fashion and still receive the separate audio and video data as needed. QuickTime's standard interleave is one second of video followed by one second of audio for the first second of the movie, and a 1/2 second interleave throughout the remainder. AVI has several different interleave options, including interleaving each frame of video with the audio.

Internet – decentralized global computer network. The term "Internet" is often erroneously used to refer to the World Wide Web, which is technically a specific application of the Internet; the Internet encompasses much more than just the Web, including email, newsgroups, chat sites, and more.

Intraframe – spatially compressed frame from which interframes are based. Also called a "keyframe" in QuickTime, and an "I-frame" in MPEG.

Intranet – large private network, often in a corporate environment.

IP – **I**nternet **P**rotocol. Commonly used protocol for transferring data over the Internet. Most networks combine IP with a higher-level protocol called Transport Control Protocol (TCP).

ISDN – moderately fast connection to the Internet. Theoretical throughput is either approximately 8 KBps or 16 KBps depending on configuration.

ISP – **I**nternet **S**ervice **P**rovider. A company which provides Internet related services, often including connectivity, email accounts, and web hosting. Increasingly, ISPs are starting to offer video hosting.

JPEG – graphic format developed by the **J**oint **P**hotographic **E**xperts **G**roup. JPEG is a lossy bit-mapped image format which is widely used for online graphics. JPEG works well for photographic images. (GIF works better for flat color illustrations.)

KiloByte (KB) – unit of measure for computer data. This unit is frequently used to designate file sizes. A KiloByte (with upper case "K" and "B") is 1024 Bytes. The term "KBps" is short for KiloBytes per second, which is a unit of data rate measurement frequently used in multimedia.

kiloByte (kB) – a unit of measure for computer data. A kiloByte (with lower case "k" and captial "B") is 1000 Bytes. This unit is rarely used.

Kilobit (Kb) – a unit of measure for computer data. A Kilobit (with upper case "K" and lower case "b") is 1024 bits. This unit is rarely used.

kilobit (kb) – a kilobit (with lower case "k" and "b") is 1000 bits. The term "kbps" is short for kilobits per second, which is a unit of data rate measurement frequently used in reference to audio data rates and telecommunications.

Keyframe – spatially compressed frame which contains the complete video image and is the basis for the following delta frames. See also "Intraframe"

kHz – **k**ilo**H**ert**z**, a unit of measure for audio sample frequency.

kps – ambiguous term for data rate meaning either Kilobytes or kilobits per second.

LAN – Local Area Network. A network that connects computers within a geographically small region, often within just one building.

Letterbox – to add black bars to the top and bottom of images that are a different aspect ratio than the display monitor. Many films are shot on wider formats than NTSC's 4:3 aspect ratio. When these movies are played on a television, black bars can be added to the top and bottom to preserve the entire original image. The other option of handling different aspect ratios is to "Pan and Scan" the image to make it the same ratio as the television.

Live – video or information that is captured, compressed, and distributed in real-time, such as "Live" news broadcasts. This is the other use of video as compared to "On-Demand".

Live Action – video that is shot on location or in a studio which contains real-world subjects, such as people, places, etc. The term "live action video" is usually used to differentiate between real-world video and computer generated video.

Local Area Network – see "LAN"

Lossless – describes a process in which no information is lost. Saving a file repeatedly with lossless compression will not affect the image quality. The QuickTime Animation codec set to 100% quality is lossless.

Lossless Format Conversion – changing a file from one format to another without having to recompress the data. For example, changing an AVI file into a QuickTime movie. Lossless format conversion is only possible with files which use codecs that are supported under both the old and new architectures.

Lossy – compression in which information is lost. Saving a file repeatedly with lossy compression will additionally degrade the image quality. This degradation is known as "generation loss". For example, Cinepak is a lossy codec.

Luminance – the brightness component of an image.

MacOS – Apple's Macintosh operating system.

Master Movie – when making QuickTime alternate movies, the master movie is the one which contains the display criteria for the other alternates as well as containing the fallback. The master movie should be embedded in a web page.

Mean Filter – filter which replaces a pixel with the average value of its surrounding pixels. Applying a mean filter effectively blurs the image.

Media – term with many different meanings. Within the context of multimedia, it usually refers to:

1. Generic term for elements such as movies, sounds, pictures, etc. (as in "multimedia")

2. Something that is used for storage or transmission, such as tapes, diskettes, CD-R's, Zip™ disks, networks, etc.

Median Filter – replaces a pixel with the "most typical" value of its surroundings, while ignoring extreme values. Applying a median filter to an image tends to remove "stray pixels" and small details.

MIDI – **M**usical **I**nstrument **D**igital **I**nterface. An architecture that is used to instruct electronic instruments how to play a piece of music – think of MIDI files as "PostScript" for music. QuickTime supports a data type called QuickTime Music which is very similar to MIDI.

Modem – computer device that connects users to a network. Telephone "Dial-up Modems" are the most common, with "Cable Modems" being a faster, but not widely available, alternative.

Movie Alternates – see "Alternate Movies"

MPEG – **M**oving **P**icture **E**xperts **G**roup. Often used to refer to the standard file format and set of compression algorithms, jointly developed by the Moving Picture Experts Group to handle video and audio. The various forms of MPEG are used for a wide range of video and audio applications, from desktop computer presentations and games to consumer DVD-Video players and satellite video systems.

MPEG-1 – format which produces high quality video and audio streams at approximately 2x CD-ROM data rates. Standard MPEG-1 is full frame rate (24 - 30 fps, depending on the source) with a quarter size image (352x240), and is useful for playback on most new desktop computers.

MPEG-2 – format which produces high data rate, full broadcast quality files. MPEG-2 playback requires an extremely fast computer and video card, or a hardware accelerator card. MPEG-2 is the format for DVD-Video and many home satellite dish systems. Standard MPEG-2 is full frame rate (24 - 30 fps) and full screen resolution (720x480).

MPEG Layer-2 Audio – Generally used for high bandwidth MPEG audio at near CD quality. Used for audio with both MPEG-1 and MPEG-2.

MPEG Layer-3 Audio (MP3) – MPEG audio format that is very popular on the Internet. Generally used in audio-only files (.mp3 files), this is a lower bandwidth format than MPEG Layer-2 audio, but still not ideal for modem streaming.

Multicast – transmitting the same media stream simultaneously to many recipients. Multicast delivery is similar to traditional television broadcast, in the sense that a stream is made available at a given time, and viewers may watch the part of that stream which is currently playing. Multicast delivery results in less network traffic than Unicast delivery, because the signal is sent once; viewers watch this signal as it is sent instead of initiating multiple unique streams.

Multimedia – refers to media presentations which combine various elements such as sound, graphics, and video.

Multimedia Architecture – software including system extensions, plug-ins, servers, etc. which provides for the creation, storage and playback of synchronized multiple media types. For example, QuickTime, RealSystem, and Windows Media.

Multiplexing (aka "Muxing" or "Interleaving") – The process of combining audio and video data in a final MPEG file. See "Interleaving"

NetShow – former name of "Windows Media," although the servers for Windows Media 3 are still called "NetShow Servers".

Noise – any part of a signal which contains unwanted randomness. In audio, noise makes the track have "hiss" or "fuzz". In video, it can make the image "grainy", and appear as pixel "shimmer" or "blotchy" areas. Noise generally interferes with compression, and should be minimized for good results.

Noise Reduction – removing unwanted noise from a signal. For video this is accomplished with filters such as blur, mean, or median. Uniform noise reduction applies one filter equally to each pixel. Adaptive Noise Reduction applies different filters to different kinds of noise.

NTSC – **N**ational **T**elevision **S**tandards **C**ommittee. The NTSC defines North American broadcast standards. The term "NTSC video" refers to the video standard defined by the committee, which has a specifically limited color gamut, is interlaced, and is approximately 720x480 pixels, 29.97 fps.

On-Demand – video which is not broadcast "Live" as it is filmed, but is compressed and made available on a server for people to watch when they wish. A television broadcast is "Live"; renting a video and watching it at home is "On-Demand".

Output Movie – compressed video ready for playback and distribution.

PAL – **P**hase **A**lternating **L**ine. The 25 fps video format used by many European countries.

Palette – list of colors which are used in an 8-bit color movie or image. There are several standard palettes, such as the Macintosh System palette. Often referred to as a "Color Lookup Table," "Color Table," or abbreviated as "CLUT".

Pan and Scan – advanced cropping technique used to translate between different aspect ratio material. "Pan and Scan" is often used to translate movies shot on wide screen film formats to 4:3 television display. In the pan and scan process, the image is cropped to the new aspect ratio, and the transfer operator pans within the wider original image to include important details which are near the edge. (These details would be lost by a simple cropping technique.) Movies which have been "pan and scanned" don't have any black bars (letterboxing) and completely fill the television screen.

P-frame (predictive frame) – MPEG difference frame which looks to previous frames. Very similar to a QuickTime/AVI delta frame.

PICT – still image file format developed by Apple Computer. PICT files can contain both vector images and bitmap images, as well as text, and an alpha-channel. PICT is a ubiquitous image format on MacOS.

Pixel – one dot in a video or still image. A typical low-resolution computer screen is 640 pixels wide and 480 pixels tall. Digital video movies are often 320 pixels wide and 240 pixels tall.

Pixelization – when the pixels that make up an image get exaggerated or enlarged. Makes the image look "chunky" or "jagged," and is often the result of compression artifacts.

PNG – **P**ortable **N**etwork **G**raphics (pronounced "ping"). PNG is new bitmap still image format designed to replace GIF. PNG is completely patent- and license-free, and is superior to GIF in many respects. New browsers (version 4 and later of Navigator and Internet Explorer) now support the PNG format.

Premiere Export Module – see "Export Module"

Process Window – "home base" for controlling processing within Media Cleaner Pro. The Process window displays the list of files to be processed, the setting with which they will be processed, and the "Start" and "Suspend" buttons.

Progressive Download – term referring to online media which users may watch as it downloads. Progressive download files don't adjust to match the bandwidth of the user's connection like a "true streaming" format. QuickTime's "fast start" feature is a progressive download technology. Also called "HTTP Streaming" because standard HTTP servers can deliver progressive download files, and no special protocols are needed.

Pulldown – introducing a pulldown is the process which compensates for the differences in frame rates between film and video by creating new frames. For 24 fps film to be converted to 30 fps NTSC video, a 3:2 pulldown is used which creates an extra six frames per second.

PureVoice codec – see "Qualcomm PureVoice codec"

QDesign Music Codec – QuickTime low bandwidth audio codec. See Codec Central for details at http://www.CodecCentral.com .

Qualcomm PureVoice codec – QuickTime low bandwidth audio codec optimized for voice-only material. See Codec Central for details at http://www.CodecCentral.com

QuickTime – Apple Computer's cross-platform multimedia architecture. Widely used for a range of applications including CD-ROM, Web video, editing, and more.

Quicktime-Compatible Browser – browser (such as Netscape Navigator 3.0 and later) that supports the inline viewing of QuickTime movies.

QuickTime Music – track that is very similar to MIDI. Allows music to be stored as instructions rather than digitized sounds, and then played back with defined instruments within QuickTime. QuickTime Music tracks are much smaller than digitized versions of the same music. Often referred to as MIDI even though it technically isn't.

QuickTime Streaming – Apple's streaming media addition to the QuickTime architecture.

RealAudio – RealNetworks' initial online audio format, which has been replaced by RealG2.

RealSystem G2 – the second generation of RealVideo. Also called simply "RealG2".

RealMedia – another name for "RealVideo".

RealVideo – RealNetworks' streaming media architecture.

Recompress – compressing an already compressed file an additional time. Recompression should be avoided if at all possible, because the video and audio quality will generally be degraded with multiple compressions.

RGB – **R**ed **G**reen **B**lue. A color space commonly used on computers. Each color is described by the strength of its red, green, and blue components. This color space directly translates to the red, green, and blue phosphors used in computer monitors. The RGB color space has a very large gamut, meaning it can reproduce a very wide range of colors.

RTP – **R**ealTime **T**ransfer **P**rotocol. A transport protocol created to deliver live media to one or more viewers simultaneously. RTP is used as the transfer protocol for RTSP streaming.

RTSP – **R**ealTime **S**treaming **P**rotocol. A standard now commonly used to transmit true streaming media to one or more viewers simultaneously. RTSP provides for viewers randomly accessing the stream, and uses RTP as the transport protocol.

Sample – measurement of a signal level at one specific instant in time.

Sample Size – accuracy with which a sound sample is recorded. Generally, audio sample size is 8 bits or 16 bits. The latter is more accurate and provides more dynamic range, but takes up more storage space.

Sample Rate – number of samples per second used for audio. A higher sample rate yields higher quality audio that is larger than lower sample rates. Common multimedia sample rates include 11.025 kHz, 22.050 kHz, and 44.100 kHz.

SECAM – video standard very similar to PAL which is used in a limited number of countries.

Server – term which can either mean hardware or software:

1. Hardware – computer that other computers connect to for the purpose of retrieving information. Often used to mean the computer that hosts a WWW site.

2. Software – software program that runs on a WWW server to support online video (such as the "RealServer").

Serverless – technologies which don't require a server, such as QuickTime.

Server-Optional – technologies which don't require a server, but may benefit from them, such as RealMedia.

Setting – name for all of the processing parameters in Media Cleaner's Advanced Settings window. Settings can be saved, modified, deleted, etc.

Settings Wizard – Media Cleaner's "expert" system which interviews the user and creates compression settings based on the user's responses.

Sorenson Video Codec – high-quality, low bandwidth QuickTime video codec – see Codec Central at http://www.CodecCentral.com for details.

Source Movie – original movie to be compressed.

Subsample – see "Color Subsampling"

SureStream – RealSystem G2 scalability feature which allows multiple versions of a file to be encoded, and delivered to users based on their connection.

Spatial Compression – compression method that removes redundant data within any given image. For example, a field of blue in a picture would be stored as one large blue area rather than many individual blue pixels.

Spikes – see "Data Rate Spikes"

Sprite Track – QuickTime track made of small graphic elements which have position and time information associated with them. These elements are called "sprites." A bouncing ball is a good example of a sprite track – only the ball and its location are stored at any given time instead of a series of bitmaps that describe each whole frame.

Static Mask – Media Cleaner feature which composites defined areas of an image across frames to improve temporal compression.

Store and Forward – alternate term for "On-Demand"

Streaming – somewhat ambiguous term which refers to network delivery of media. May refer to technologies which match the bandwidth of the media signal to the viewer's connection, so that the media is always seen in real-time ("True Streaming"). Also commonly used to mean media which may be viewed over a network prior to being fully downloaded ("HTTP Streaming" and "Progressive Download").

Suffix (aka "Extension") – last part of a file name that indicates the type of file. The common online video suffixes are:

QuickTime	.mov
RealVideo	.rm
RealVideo metafile	.ram
Windows Media	.asf
Video for Windows	.avi
MPEG Layer-3 Audio	.mp3
MPEG	.mpg

Symmetric Codecs – codecs which encode and decode video in the same amount of time. Live broadcast and teleconferencing systems generally use fairly symmetric codecs in order to encode the video in realtime as it is captured.

T1 – fast network connection. Theoretical limit is 150 KBps, but the realities of the Internet usually cut the throughput down dramatically.

TCP – **T**ransfer **C**ontrol **P**rotocol. Common network transfer protocol used widely on the Internet.

Text Track – track which is made up of text, style, positioning, and time information. QuickTime text tracks are often used for subtitles.

Target Machine – typical/minimal configuration (of computer hardware and software) on which a movie will be viewed.

Telecine – film-to-video conversion machine that introduces the 3:2 pulldown necessary to compensate for the differences in frame rates between film and video. 3:2 pulldown is undesirable in compressed movies, and should be removed with Media Cleaner's Intelecine feature.

Temporal Compression – video compression which compares frames and only transmits the differences between them. Also called "interframe" compression.

Terran – of, or relating to, the planet Earth (as in "Terra Firma"). Rhymes with "baron".

TIFF – **T**agged **I**mage **F**ile **F**ormat. A widely supported cross-platform file format for storing bit-mapped images. Often used in pre-press.

Toggle – little triangle shaped button which rotates to reveal more information. Similar to the little triangles in the Finder that let you view the contents of a folder without first opening it. Clicking once on them reveals more information; clicking again hides the extra information.

Tracks – separate media types that make up a movie. Most movies include a video track and an audio track. In some multimedia architectures such as QuickTime, there are also text tracks, sprite tracks, music tracks, and more unusual track types.

Transcode – term that generally is used to mean "Recompression," but can also mean "Lossless Format Conversion."

True Streaming – refers to technologies which match the bandwidth of the media signal to the viewer's connection, so that the media is always seen in real-time. The word "True" is added to differentiate this type of streaming from "HTTP Streaming" (aka "Progressive Download"). Media servers and streaming protocols such as RTSP are required to enable true streaming.

UDP – **U**ser **D**atagram **P**rotocol. The data transmission standard used by RTP for broadcast data over IP networks. UDP is designed for realtime broadcast, and thus lacks many of the error correction features of TCP, because there isn't time to resend lost data. This means that UDP may lose data in transmission if there are problems with the network.

Unicast – delivery of a unique stream to each viewer. Because each viewer initiates a new stream when viewing the same source, this approach to media delivery can result in increased network congestion as multiple, identical streams are sent at the same time. However, unlike "Multicast", Unicast delivery allows for each viewer to control their viewing, so this is much more akin to "video on demand", rather than a television broadcast.

Upload – to move a file from your computer to a server.

Variable Bitrate (VBR) Encoding – a two-pass process of analyzing and then compressing movies to an optimal data rate. Produces movies with data rates which vary from second to second instead of uniform, flat data rates. Media Cleaner supports VBR encoding with the Developer Edition of Sorenson Video.

Variable Frame Length Movie – movie that contains frames that are not all of equal duration. Supported by QuickTime, but not Video for Windows.

Vector – in multimedia, vector refers to formats which stores graphical information in terms of mathematical algorithms, instead of as pixels. Because these images don't have any pixels, but are rather equations describing the objects portrayed, vector images scale perfectly to larger and smaller sizes. Illustrator files, Flash, and QuickTime curve media are vector formats.

Vector Quantization (VQ) – a compression technique used by Sorenson Video which uses representative pixel patterns to compress an image and later reconstruct it.

Vertical Edge Blanking – see "Edge Blanking"

Video for Windows – (also called "AVI") Microsoft's initial multimedia architecture primarily aimed at CD-ROM video. It is being replaced by DirectShow/Windows Media.

Volume –
1. A hard disk drive, floppy diskette, CD-ROM, or other storage device or piece of storage media.

2. The level of your audio track.

WAN – Wide Area Network. A network connecting a large area, usually more than one building.

Web – short for "World Wide Web."

Wide Area Network – see "WAN"

Windows – Microsoft's operating system.

Windows Machine – IBM-compatible computer running Microsoft's Windows operating system.

Windows Media – Microsoft's streaming media architecture. Formerly called "NetShow."

Wizard – generic term for a system that helps users configure computer software or settings. See "Settings Wizard"

World Wide Web – hyperlinked, graphical application of the Internet.

WWW – short for "**W**orld **W**ide **W**eb".

xDSL – refers collectively to all types of Digital Subscriber Lines. See "ADSL" for more details.

YUV – Color model which describes color information in terms of luminance (Y) and two chrominance channels (U,V). The YUV space is commonly used in video, and easily supports color subsampling.

YUV9 – color format with substantial subsampling often used with online video technologies, such as Sorenson Video. For every 16 luminance "Y" samples in a 4x4 pixel block, there is only one "U" and one "V" sample. This dramatic color subsampling produces smaller files, with correspondingly lower color fidelity. YUV9 subsampling often results in noticeable color artifacts around the edges of brightly colored objects.